The Impact of the Agricultural Minimum Wage and the Role of Enforcement in South Africa[1]

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Masters in Applied Economics Dissertation

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1. Introduction

"If you raise the minimum wage a little - not a huge amount, but a little - you won't necessarily cause a big employment reduction. In some cases you could get an employment increase." David Card, UC Berkeley, Interview with the Institute for Research on Labour and Employment, December 2006.

"Just as no physicist would claim that "water runs uphill", no self-respecting economist would claim that increases in the minimum wage increase employment." - James M. Buchanan, 1986, Nobel Laureate in Economics, Wall Street Journal, April 1996.

The introduction of national minimum wages in South Africa is a relatively recent phenomenon by international standards. Historically New Zealand was the first country to introduce minimum wage legislation. This was done in 1894, followed shortly afterwards by Australia and later the United Kingdom and the United States (Starr, 1981). While employee relationships in South Africa were partially governed by the Master and Servants Act (1896) and the Industrial Conciliation Act (1924) - later to become the Labour Relations Act (1956) - it was not until 1999 that the first official national minimum wage legislation was passed[2]. Since 1999 South Africa gradually developed a detailed minimum wage schedule covering eleven sectors of the economy. Labour market institutions were also created to enforce the new laws; the efficacy of which has hitherto remained unexamined. The legislated minimum wage in South Africa varies across, and within sectors. Mandated wages within a sector can differ depending upon occupation type, the number of hours worked, as well as geographic location. There is thus no single national minimum wage[3].

Internationally, minimum wages are widely used as a policy tool to protect vulnerable workers from exploitation and help alleviate poverty. In South Africa the socioeconomic arguments supporting minimum wages are well established, that is, minimum wages aim to redistribute earnings to low paid workers, assist workers with weak bargaining power, and lift the working poor out of poverty. The economic effect that minimum wages have, on employment in particular, is a classic labour economics question which has attracted considerable attention in the international literature. However, as the two introductory quotes illustrate, there is some disagreement among economists as to the precise impact of minimum wages. More broadly there are those who question whether minimum wages are a welfare-enhancing intervention at all. The recent introduction of minimum wage laws in South Africa makes comprehensive enquiry into such issues particularly pertinent for economists and policymakers. It is therefore surprising that few empirical studies have investigated the

[2] This was for the Contract Cleaning sector.

[3] The minimum wage regulations for each sector are contained within a Sectoral Determination; this is a legal document which refines conditions outlined in the Basic Conditions of Employment Act (BCEA, 1997). In addition to prescribing minimum wages this document outlines legal requirements for written employment contracts, hours of work, leave, and termination of employment.

impact of these policies on the local labour market. In an effort to begin filling the gap this paper focuses on the agricultural sector in South Africa.

The first component of this paper investigates and measures the aggregate impact of the Agricultural Sectoral Determination. Observing changes in farmworker earnings, contract coverage, employment, and the number hours worked per week, provides insight into the impact of the law. These changes are examined using data from the South African Labour Force Surveys (LFS) 2000-2007 which includes three years before the law was introduced and four years afterwards. Descriptive statistics and difference-in-differences regressions are used to analyse the impact of the law. A control group, made up of similar workers not subject to the law, is used for comparison. Results show that the Sectoral Determination caused significant growth in average farmworker earnings and an increase in the number of workers holding written employment contracts. However, the probability of agricultural employment for a typical worker appears to have fallen, while hours worked were unaffected.

After analysing these changes, the second component of the paper examines the associated and underexplored issue of enforcement and compliance. The number of farmworkers receiving sub-minimum wages (i.e. noncompliance) in South Africa is high and thus the observed impact of the law can be seen as a lower bound. I test to see whether the increase in wages which occurs over the period can be linked to formal enforcement of the Sectoral Determination. The number of labour inspectors per capita in each province is utilised as a measure of the level of enforcement. In addition I use the presence of a local Labour Centre as a broad but more disaggregated measure of enforcement. The evidence suggests that existing government enforcement has had no observable effect on compliance in the post-law period. To explain this result a theoretical model of employer compliance is presented. The model uses inspection data from the Western Cape .the province with the lowest levels of violation in the country. It is shown that the economic benefits of noncompliance for an average employer far outweigh the expected costs, thus the typical profit-maximising employer should opt for noncompliance. I then use an ‘index of violation derived in Bhorat, Kanbur and Mayet (2012) to analyse changes in compliance that have occurred in the post-law period. This index allows one to analyse the depth of minimum wage violation over time and in this manner test for partial compliance with the law. Results suggest that many employers have increased wages after the law, but not all the way up to the minimum.

The paper is laid out as follows. Section 1 continues to briefly review key papers in the minimum wage literature and then examines the emerging research on enforcement and compliance. Section 2 begins by describing the data and addressing possible data issues. In Section 3 the empirical approach and method are outlined and explained. Section 4 presents evidence on the effects of the law. Here I explore the impacts of the minimum wage on: employment, farmworker earnings, contract coverage, and hours worked, using descriptive statistics as well as statistical tests which isolate the direct impact of the law. Section 5 describes the enforcement process in South Africa in brief and then examines the effect of formal enforcement activities on compliance using statistical tests. I show that employer incentives en- courage violation but that partial compliance with the law is observed by

examining changes in the depth of violation over the period. Finally, Section 6 concludes and comments on the findings.

1.1 International Minimum Wage Literature

Theoretical work on the effects of minimum wages in the labour market began in America around the early 1940s with economists such as George Stigler (1946) and Andrew Lester (1947). Both authors postulated models explaining how employment would respond to minimum wage increases depending on the structure of the labour market. Consequently, others in the profession began accumulating empirical evidence to examine the issue in more detail. This debate became critically relevant to American policymakers given that by 1975 over ninety percent of the workforce was covered by federal minimum wage laws (Brown, 1999). Consensus came to hold that minimum wage increases of ten percent would reduce employment by between one and three percent on average (Brown, Gilroy, Kohen, 1982). For various reasons, by the early 1990s the minimum wage question reappeared in public policy debates and researchers began to re-examine the accumulating evidence[4]. In particular, one strand of work moved away from the standard time-series analysis which had formed the core of previous empirical studies. Instead researchers used state-level variations in wages and economic conditions to examine the impact of the minimum wage. Essentially this provided a natural experiment where the effect of the minimum wage on a particular group of workers could be isolated by comparing their outcomes with a similar group not subject to the law. Research in this vein became classified as the new minimum wage literature and it is upon such work that this paper builds.

The new minimum wage research began in the 1990s with Card (1992), Card and Krueger (1994, 1995), Neumark and Wascher (1992), and has provided valuable insights into labour market dynamics. The research has also generated extensive discussion around the specific effects of minimum wage policies. Debate was initially sparked by the provocative findings of David Card and Alan Krueger's (1994) seminal paper on the subject. Card and Krueger's work on the fast food industry in New Jersey produced evidence showing that minimum wage increases may not always lead to employment decreases and in some cases may even increase employment. A portion of subsequent research supports Card and Krueger's findings[5]. While such findings are compelling and have forced economists to reconsider long-held beliefs on the subject they have not overturned the consensus that in almost all cases higher wages will reduce employment. The weight of accumulated evidence from subsequent work appears to favour a nuanced version of this traditional economic rationale. Neumark and Wascher (2007) offer the most comprehensive review of the new minimum wage literature to date and draw several important conclusions[6]. They conclude from their review

[4] See Neumark and Wascher (2007) for a detailed explanation.

[5] See Machin and Manning (1994), Bhaskar and To (1999), Houba and van Lomwell (2001), Petrakis and Vlassis (2004). The explanatino for why minimum wages can increase employment relates to the specific market structure, see Card and Krueger (1994) for a full explanation.

[6] For particular studies see: Card (1992), Card and Krueger (1994, 1995, 2000); Neumark and Wascher (1992); Katz and Krueger (1992); Spriggs and Klein (1994); Deere, Murphy and Welch (1995); Baker, Benjamin and Stanger (1999); Neumark and Wascher (2000); Burkhauser, Couch and Wittenburg (2000a, 2000b); Bernstein and Schmitt (2000); Zavodny (2000); Couch and Wittenburg (2001); Keil, Robertson and Symons (2001); Rama

that there are very few if any studies that provide convincing evidence of positive employment effects of minimum wages (Neumark and Wascher, 2007:121). In fact evidence shows that negative employment effects are consistently apparent when a study does not restrict its focus to a narrow sub-group or single industry. The authors add that "studies [which] focus on the least-skilled groups provide relatively overwhelming evidence of stronger disemployment effects for these groups" (Neumark and Wascher, 2007:121).

Importantly, the Neumark and Wascher (2007) review does not discount work which presents evidence of negligible or even positive employment impacts in certain cases. Rather, they emphasise that the precise effects of increases in the minimum wage have become an empirical question. The extent of any effects depend significantly on the economic context, and, especially in developing countries, the extent to which employers actually comply with the law should not be overlooked (as I illustrate below). Finally, in the event of introducing new minimum wage legislation, the level at which the minimum is set relative to existing wages can make a significant difference[7]. The points raised here should help inform expectations in the case of South Africa.

1.2 South African Minimum Wage Literature

Reliable economic research studying the effects of minimum wages in South Africa is limited and published work that compares with the international literature is even more so[8]. The most comprehensive research that is available has focused on the effects of the Sectoral Determination on domestic workers. Unpublished papers by Hertz (2005, 2006) and more recently Dinkelman and Ranchhod (2010) examine the impact of the legislation on a number of observables in this sector. The authors use contrasting methodologies but their overall conclusions are comparable[9]. Immediate and significant increases in earnings are reported after the introduction of the law in both studies; this increase is evident despite the fact that compliance is low. The requirement for employers to establish a written contract with employees formed part of the new legislation and again both studies found that the number of domestic workers with such contracts increased significantly in the post-law period. Regarding employment, Dinkelman and Ranchhod (2010) present a model showing that the probability of employment for a typical domestic worker is unchanged after the law, while Hertz (2005) suggests that changes in employment experienced by domestic workers was no different to workers in other occupations. The results suggest that employment was not adversely affected by the law, even though wages rose. I employ methods of testing which incorporate the approaches used by both authors to examine the case of agricultural workers. In particular, the methodological approach of Dinkelman and Ranchhod (2010) informs a large portion of this paper.

(2001); Strobl and Walsh (2003); Alatas and Cameron (2003); Chapman (2004); Gindling and Terrell (2004); Bazen and Le Gallo (2006), Allegretto, Dube and Reich (2008, 2010, 2011).

[7] Work by Nicole Fortin and Thomas Lemieux (2000) provides a clear example of this.

[8] One reason for this may be the complex minimum wage schedule in South Africa which makes econometric analysis using the available household survey data very difficult.

[9] The most important methodological contrasts between the two papers are that Hertz (2005) employs a difference-in-differences approach similar to Card and Krueger (1995) and uses Magisterial Districts as the unit of analysis, while Dinkelman and Ranchhod (2010) use a difference-in-differences approach found in Lee (1999) with the Province as the unit of analysis.

A report by the Development Policy Research Unit (DPRU, 2008) prepared for the South African Department of Labour (DoL) examines the effect of the Sectoral Determinations on a range of labour market variables. Specifically, the effects on earnings, poverty and employment are estimated for each sector and for the economy as a whole. This analysis involves examining sector-specific data over time, as well as calculating the economy-wide effects using a general equilibrium model. While the report does not statistically isolate the influence of each Sectoral Determination over time it does provide some useful results. On average the data shows that real wages have risen between 2001 and 2007 in all sectors. Through the calculation of employment-output elasticities the study finds a small, positive relationship between wages and employment for nearly all sectors. Notably, this positive relationship is absent in the Agricultural sector which appears to have experienced 'jobless growth'. The minimum wage may have had some impact here. Employment in Agriculture is reported to have declined by 4.9% over the period. Lastly, the overall poverty-reducing effects of the law are found to be limited. The report opines that this may be due to low levels of compliance in all sectors and the fact that many low-income households rely on non-wage income such as social grants. It is also argued that aggregate income gains resulting from the minimum wage are offset by inflation, or possible employment losses in the case of agriculture.

Two final South African studies analyse the impact of minimum wages in the agricultural industry. Both authors focus on a subset of workers using independently collected survey data. Conradie (2004) presents a detailed study of wine and table-grape farmers in the Western Cape, while Murray and Van Walbeek (2007) conduct a case study of farm workers in the Kwazulu Natal sugar industry. Conradie (2004), using data from a survey of 190 grape farmers, calculates an elasticity of demand for labour which is relatively inelastic. She shows that a wage increase of ten percent will decrease employment by between three and six percent, depending on the industry. Disemployment effects are revealed to be lower on wine farms because labour is a smaller cost item. The conclusion follows that higher wages do appear to reduce employment, but only slightly. Contrastingly, Murray and Van Walbeeck (2007) use data from a survey of 103 sugarcane farmers and report no large disemployment as a result of the law. The authors do suggest that decreases in the average number of hours worked have occurred due to the minimum wage, and that there was a move from labour to capital-intensive farming methods where possible. The reported move toward capitalisation makes the fact that there are no large disemployment effects quite surprising. Unfortunately the study relies only on qualitative data gleaned from interviews with farmers and lacks empirical rigour. Both papers suggest that the specific effects of the law may differ by industry and region.

The existing body of work (although sparse) does provide insights which help to inform the approach and method in this paper. It is clear from past work what effect the Agricultural Sectoral Determination should have on earnings and contracts in the sector. Less clear are expectations around the impact on employment and the average number of hours worked per

person. Even less apparent is what result should be expected from the equally interesting enquiry into the effect of formal enforcement on compliance. The issue of enforcement and compliance is one which holds particular relevance for the developing world where noncompliance is high.

1.3 International Enforcement Literature

In general, regulatory institutions are more developed in industrialized countries where noncompliance tends to be lower and less of a central concern (Basu, Chau and Kanbur, 2007). Contrastingly, noncompliance is a serious problem in developing nations and therefore requires more attention. If minimum wage legislation was comprehensively enforced in developing countries the overall effects of minimum wages on employment and other outcomes would be substantially greater[10]. The mechanics of minimum wage enforcement and compliance in such contexts is an area of the labour market which is under-researched but one which is essential to a comprehensive understanding of labour market dynamics, and carries significant policy relevance.

In contrast to the rich international work on the impact of minimum wage laws there is an insubstantial literature on the enforcement of these regulations. Indeed many studies on the impacts of the minimum wage implicitly assume that full compliance exists. There is, however, a small economic literature on the subject of compliance which began with Ashenfelter and Smith (1979). The standard economic models of enforcement predict low levels of compliance whenever the costs of complying with the law exceed the expected costs of violation, for a typical firm (See Ashenfelter & Smith, 1979)[11]. In a setting with comparatively weak formal enforcement mechanisms and insubstantial penalties .a description which I show defines South Africa's situation .one would expect low levels of compliance. While the theoretical research has become fairly advanced, empirical work on enforcement and compliance remains underdeveloped[12]. This subject is revisited in Section 5.

Evidence from a handful of developing country studies shows that compliance is indeed low. These few studies also reveal that the problem of compliance with minimum wage laws remains largely unexplored. Jones (1998) finds that minimum wage laws in Ghana reduce formal-sector employment but increase informal-sector employment. The assumption is that compliance in the informal sector is low and thus it can absorb the unemployed but pays wages below the regulated minimum. In general it is difficult to quantify the impact of formal

[10] For example, Strobl & Walsh (2003) propose a model which shows that the potential costs of minimum wage laws in Trinidad and Tobago would rise significantly in a scenario of full compliance.

[11] The typical model is a simple calculation which sets the expected gains from violation against the gains from compliance:

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Where Π is firm profit, M is minimum wage, r is rental rate, p is price, λ is probability of inspection, w is optimal wage, and D is the penalty for violation. In this equation if the profit from violating minus the penalty exceeds zero the firm will violate. For more work on enforcement see Grenier (1982), Chang & Erlich (1985), Weil (2005), and Basu, Chan & Kanbur (2009).

[12] See Basu, Chau & Kanbur (2009) for a brief review of this literature and the latest theoretical contribution.

enforcement. This is largely due to the lack of data in most developing countries, and the fact that enforcement itself is difficult to measure. Ronconi (2008) uses the number of labour inspectors as a proxy for formal enforcement in Argentina. The study finds a positive relationship between the number of inspectors per capita and the extent and size of penalties imposed. It was also evident that provinces with a higher number of labour inspectors per capita were more likely to comply with labour regulations. This will be tested in the case of South Africa.

Another study investigating enforcement in Latin America was undertaken by Almeida and Carneiro (2008). The authors investigate enforcement of labour market regulations in Brazil. They find that an increase in the number of inspections was associated with an increase in the share of registered workers. In addition, more inspections are related to better social security coverage for workers and a greater probability of earning the minimum wage. The study also found that a higher level of enforcement exists in the richer and more developed cities of the country. Lastly, Andalón & Pagés (2008) investigate the enforcement of minimum wages in Kenya and provide comparable evidence. Minimum wages were better enforced and had stronger effects in urban areas than in the agriculture industry. Additionally the authors estimate that a ten percent increase in the minimum to median wage ratio is associated with a decline in the share of formal employment of up to six percent. However, this is found to be offset by an increase in self-employment of similar magnitude. Such compensatory increases are less likely to occur in an agricultural sector such as South Africa's where the informal sector is extremely small by international standards (Devey, Skinner, and Valodia; 2006).

1.4 South African Enforcement Literature

South African research focused on the enforcement of minimum wage laws is almost non-existent. Very little has been done to firstly, measure the levels of compliance with the new Sectoral Determinations; and secondly, understand the nature and extent of the enforcement of labour regulation and the role of the authorities. It is unclear what impact formal enforcement mechanisms have on employer compliance, if any. In a pioneering study Bhorat, et al. (2012) show that compliance with minimum wage laws in South Africa is low .with over 45% of all covered workers receiving sub-minimum wages in 2007. The authors investigate the determinants of this compliance. Their findings show that labour inspectors, firm size, the local unemployment level, and certain personal characteristics, all influence whether an individual receives sub-minimum wages. In this paper I show that despite observing similarly high levels of noncompliance in the agricultural sector, wages are rising in the wake of the law. The interesting question is therefore whether this 'partial' compliance by employers is linked to formal enforcement or not.

A technical report written by the International Labour Organisation (ILO, 2010) identifies a number of possible reasons why enforcement has been unsuccessful in achieving higher levels of compliance. Based on a nine-day visit to the South African DoL they highlight a few key problems which include: a lack of qualified staff, poor remuneration, and an absence of collaboration with other interest groups. The report also identifies a general lack of knowledge in the economy surrounding the new labour laws and the existence of formal

labour inspection. These are cited as possible reasons for the high levels of violation found by Bhorat et al. (2012). While this report is informative in exploring the functioning of the Labour Inspectorate it does not present any empirical evidence on enforcement or examine the impact that enforcement has on compliance. This is a question I aim to address.

Analysing the impact of the Agricultural Sectoral Determination and exploring the effect that the enforcement of these regulations has had, is important. This work sheds light on what happens when minimum wages are introduced into a low-wage, unskilled sector and explores formal enforcement in a developing country context, providing some initial evidence on the effects in the case of agriculture in South Africa. A discussion of the data used in this analysis is the focus of the following section.

2 Data Issues

2.1 The Labour Force Survey (LFS)

The primary data for this study are drawn from 15 waves of the Labour Force Survey (LFS), starting in September 2000 and ending in September 2007. These are bi-annual, rotating panel, surveys conducted in February/March and September each year and all data are self-reported. The chosen sample includes six waves before the legislation's effective date (March 2003) and nine afterwards. Given the relatively high frequency of the surveys it is possible to analyse the immediate effects of the law. All 15 waves are pooled and treated as repeated cross sections over time[13]. The LFS covers approximately 30,000 households in each wave and this includes between 2,000 and 2,800 farmworkers per wave over the period. In order to evaluate which minimum wage applied to each individual it was necessary to assign individuals to geographic areas. This was done by matching geographical information available in the LFS to areas A and B listed in the Sectoral Determination (See Appendix Table A1).

2.2 Sample Selection and Key Variables

Section 1 and Section 34 of the Sectoral Determination for Farmworkers (2002) specifically define the individuals to whom the legislation applies. Based on this I identify the relevant sample of farmworkers in each wave of the LFS by the overlap of two distinct classifications: the four-digit SASCO[14] occupation codes as well as the three-digit ISIC[15] industry codes. Those individuals who are classified as agricultural workers in the LFS but to whom the law does not apply are excluded – these include subsistence farmers, independent contractors and managers or professionals. The sample thus disregards individuals to whom the Sectoral Determination does not apply. It must be noted that existing data on workers in the agricultural sector available from Statistics South Africa and the Department of Agriculture

[13] Pooled data offers the advantages of large sample sizes, the ability to create variables that elude study in the simple cross-sectional case, and the ability to capture cross-sectional and over-time variation simultaneously (Podestà, 2002). I choose not to create a panel using the LFSs as this would result in too small a sample size over the period in question, see Dinkelman and Ranchhod (2010) for a complete explanation.
[14] South African Standard Classification of Occupations (SASCO).
[15] International Standard Industrial Classification of all Economic Activities (ISIC).

base their classification of farmworkers only on the ISIC industry codes. This does result in some significant aggregate differences which prevent direct comparison of variables such as employment, for example.

In order to assess whether the changes experienced by farmworkers are unique I identify a control group that has similar characteristics to farmworkers. The statistical analysis is used to check if the observed changes are shared by this comparable group of workers who are not subject to the law. The control group is made up of unskilled, non-unionised individuals of working age, who are not covered by another Sectoral Determination which might interfere with the results. Here again, both the occupation and industry codes are used to identify this group. For clarity, this group includes occupations such as: street vendors, packers, municipal garbage collectors, construction workers, manufacturing and transport labourers, and elementary machine operators. The agricultural minimum wage law does not apply to them and is set at a level far below their median wage. Changes in the control group's wages, employment, contract coverage and hours worked give an indication of movements in the economy when the agricultural minimum wage was introduced.

Monthly wages reported in brackets in the LFS are transformed into point estimates by random allocation to a uniform distribution within the bracket to maintain variation[16]. This accounts for between five and ten percent of the sample in each wave on average. All monthly wages are then combined and converted into hourly wages. The conversion uses responses to the question "How many hours do you usually work in a week?" to obtain the number of hours worked per week for each individual. Wages are deflated by the annual Consumer Price Index (CPIX) when analysing changes over time. Individuals who report no earnings at all are excluded from the sample, as are those who report working more than fifteen hours a day, and those with monthly income high enough to exempt them from the legislation. Maximum earnings for farmworkers covered by the legislation are defined in the Sectoral Determination and are equivalent to the eligibility regulations for UIF contributions and threshold earnings in the BCEA[17]. The sample includes all individuals of working age (15-64) who work at least 27 hours per week (i.e. full-time workers)[18].

Finally, regarding enforcement and compliance, the data on Labour Inspectors were obtained directly from the South African DoL. The data details the number of inspectors employed in each province from 2002-2007 which is used as a proxy for formal enforcement of the

[16] A new seed is set in STATA for each bracket calculation.

[17] Maximum monthly earnings:

Binding from date	Monthly maximum earnings
January 2000	R7 774
January 2001	R8 099
April 2003	R8 836
October 2005	R10 966
July 2006	R11 662
October 2007	R12 478

[18] I use full-time workers as defined by the DoL, and exclude those working less than 27 hours per week as a different minimum wage applies to them.

legislation. The other proxy for enforcement is the number of Labour Centres in each Magisterial District which can be obtained from the DoL's website[19]. These Labour Centres where then matched to the broader geographical unit of the District Council (See Table A1 in the Appendix). Data on inspections and penalties were obtained from the Western Cape Inspection and Enforcement Services (IES), containing information on the number of inspections conducted in the agricultural sector in 2007 as well as the levels of compliance. Additionally, interviews and focus groups with labour inspectors and IES officials in the Western Cape were conducted. These provided important insights into the enforcement process.

2.3 Sample Weights

A further aspect of the data worth highlighting is the choice of sample weights for this analysis. A concern raised by Dinkelman and Ranchhod (2010) as well as Hertz (2005) is that the sample weights for the LFS 2001 and LFS 2002 are linked to the 1996 South African Census, while the weights for the post-2002 surveys are benchmarked to the 2001 Census. This generates inconsistencies (See Hertz, 2006). If one intends to analyse cross-sectional data over time it is important that the data produce accurate trends. As Branson (2009) points out, there are two main concerns with the LFS weights: "First, the auxiliary data used as a benchmark in the post-stratification adjustment is unreliable and inconsistent over time and hence results in temporal inconsistencies even at the aggregate level. Second, since the adjustment is made at the person level until 2003, there is no hierarchical consistency between the person and household weighted series. This means that analyses done at the household and person level will not necessarily agree" (Branson 2009:5). Branson (2009) has created a new set of individual weights using entropy estimation which are shown to be more reliable. For these reasons I do not use the standard LFS individual-level weights but rather those provided by Branson (2009)[20]. I continue to use the post-stratification unit (PSU) and district level weights from the LFS which adjust for the survey design.

2.4 Data Limitations

Some data limitations facing this study must be mentioned. Firstly, Fallon and Lucas (1998) give reason to believe that the elasticity of labour demand in South Africa can vary considerably within a sector. Thus average figures for the entire agricultural sector may not pick up significant intra-sector variation. Unfortunately, given the constraints of the LFS data higher levels of disaggregation are not possible; however, a sectoral study of this nature can nonetheless prove valuable by providing a sense of aggregate impacts. Secondly, as noted by Hertz (2005) and Dinkelman and Ranchhod (2010) it is impossible to capture any non-monetary income received by farmworkers such as housing, food, transport, utilities or any other in-kind transfers from employers. Importantly the legislation does restrict such non-monetary payments to ten percent of a worker's salary in the case of agriculture and this is taken into account where necessary. Nevertheless it is possible that increases in wages after

[19] The website is: www.labour.gov (Many thanks to Taryn Dinkelman for sharing information on coded Labour Centre data).

[20] The weights are now publicly available from Data First at the University of Cape Town: www.datafirst.uct.ac.za

the introduction of the law may have been a reallocation of non-pecuniary benefits offered in the pre-law period. This is the biggest challenge for analysing wage gains in the sector.

Thirdly, the variations in the reported earnings of agricultural workers are larger than expected which make it di¢ cult to predict national average wage figures with high levels of confidence. Logarithmic transformations are used in the econometric analysis to generate a normal distribution of wages. Moreover, in the statistical analysis earnings are clustered at the district level where the variance is lower. Fourthly, it may be that a common employer response to the law is the casualization of labour. Anecdotal evidence suggests that this may be the case in agriculture where labour brokers are increasingly prevalent and coordinate less direct formal employment and more subcontracting (DoL, 2011). There may be a correlation in South Africa between stricter wage legislation (higher minimum wages, restrictions on dismissal etc.) and the growth of the labour broking industry. However, the LFS data on seasonal and contract workers within agriculture does not appear to have changed significantly over the period and no data on labour brokers is available. Finally, the data on labour inspectors is only available at the provincial level and thus may fail to pick up the effect of enforcement accurately. The use of Labour Centre per District Council is an attempt to find a more localised measure of enforcement.

3 Approach and Method

3.1 The Effects of the Law

Simple cross tabulations initially introduce the relevant data and provide a picture of general changes that have occurred over the period 2000-2007. Data for agricultural workers as well as the control group are presented. This is augmented by non-parametric kernel densities which are estimated for farmworker and control group wages to highlight the changing wage distributions over time. Kolmogorov-Smirnov tests compare the distributions[21]. Finally, I test statistically for whether the observed changes are linked to the introduction of the law, and whether these changes are larger in areas where the gap between farmworker wages and the control group wages is greater.

Two specifications are used. I first employ a standard difference-in-differences model analogous to Card and Krueger (1994):

(1)

where, is the outcome of interest (wages, contracts, hours worked) for individual *i*, in group , in period *t.* is the time dummy which captures 'before-and-after' effects. is the dummy for whether an individual is in the treatment or control group (k=1, 2), which equals 1 if the individual is a farmworker and 0 if they are in the control

[21] This is a nonparametric test for the equality of distributions, it can be used to compare two samples and test the likelihood that they are drawn from the same distribution.

group[22]. is the difference-in-differences term which confirms that outcomes are not the result of economy-wide shocks. This ensures that the observed changes are not shared by similar workers to whom the law does not apply.

Secondly I specify a difference-in-differences model similar to Dinkelman and Ranchhod (2010) which tests to see whether wages increased more in areas where farmworker wages were lower in the pre-law period:

, (2)

where, is the outcome of interest for individual *i*, living in district *j*, in period *t.* is the time dummy, and controls for various worker characteristics such as Age, Education and Race. The wage gap ( ) is a constructed variable which identifies cross-sectional variation between District Councils in the pre-law period. I specify the wage gap as:

)], (3)

where is the median wage of the control group in district j and is the median agricultural worker wage in district j. The wage gap is calculated using full-time wages in 2002. This identifies the gap in wages between the two groups of workers for each district, in the pre-law period, and captures the intensity of the law. Areas with a larger gap would be expected to experience greater increases in wages in the post-law period if the law was binding. Comparison with the chosen control group accounts for any changes in wages that affected all workers over the period and controls for wage differences that are linked to geography.

Dinkelman and Ranchhod (2010) construct a wage gap which is the difference between the legislated minimum wage and the median domestic worker wage, in the pre-law period. This is to see whether wages increased more in areas where the minimum wage had more 'bite'. Importantly, their unit of analysis is the province. The fact that there are only nine provinces presents difficulties for reliable inference in this case. As a remedy the authors apply two separate corrective techniques which adjust the standard error - they use Eicker-White standard errors, and employ a two stage least squares regression technique. Hertz (2005) avoids the problem by using Magisterial Districts as the group level identi.er and thus has 361 units of analysis instead of only nine. Unfortunately, as Dinkelman & Ranchhod (2010) point out, this leads to worryingly small within-cell sample sizes because certain Magisterial Districts contain less than ten observations. Taking both of these problems into account I propose a specification that uses District Councils as the unit of analysis instead of Provinces or Magisterial Districts[23]. There are 55 District Councils classified in the LFS which can be

[22] Recall that the control is made up of demographically similar workers not covered by the minimum wage law. Characteristics of the control group are presented in the following section and shown in Table 2.

[23] Magisterial Districts are smaller geographic areas than District Councils and are used as the standard geographic classification unit in the LFS from 2001-2003, this is then changed from 2004 onwards to District Councils.

used as units of analysis[24]. The estimates presented in this paper should therefore be more accurate than past work as they exploit greater cross-sectional variation but avoid small sample sizes which can bias the estimates. Moreover, this is a more disaggregated measure which may pick up changes that a provincial variable would overlook.

In equation (1) indicates the changes in the post-law period for both groups, gives the average difference between farmworkers and the control group over the full period, and shows the change for farmworkers in the post-law period relative to the control group. In equation (2) the parameter represents the average difference in outcomes for workers in low wage gap versus high wage gap areas across the entire period. is the difference-in-differences parameter and tells us how much more outcomes changed in the post-law period, in areas where the wage gap was largest. Lastly, is also of interest as it tells us how the variable of interest changed on average after the law. As in all such natural experiments I must assume that in the absence of the law agricultural wages would be on the same general trend across districts as well as for both groups of workers.

3.2 Enforcement and Compliance

Given that large wage responses are observed for farmworkers it is important to explore whether formal enforcement affects employer compliance. To investigate the extent that external enforcement may have affected compliance two different models are used. Firstly, a difference-in-differences equation shows that employer responses do not vary significantly across areas with different inspection probabilities. Secondly a test for partial compliance, using an 'index of violation', shows that many farmworker's wages have increased towards, but not up to, the legislated minimum.

The difference-in-differences specification is identical to equation (2) but uses an enforcement variable in place of the wage gap.

(4)

where is the wage for individual i, in area j, at time t, and include individual characteristics. is the number of labour inspectors per capita in each province. This is intended to capture the effect of formal enforcement on the employer decision to pay higher wages. Given that data on inspectors is only available at the provincial level I use Eicker-White clustered standard errors at the group level[25]. I also make use of Labour Centre data and run the same set of regressions. Here becomes the number of Labour Centre's in each District Council. The hypothesis remains the same. It is expected that a greater inspector presence (captured by the number of inspectors or the presence of a Labour Centre) should result in a higher probability of inspection and thus more compliance by

[24] Using the geographic codes available from Statistics South Africa I code Magisterial Districts for 2001-2003 into their respective District Councils and use this as the standard unit across all years. See Table A1 in the Appendix.

[25] See Donald and Lang (2007) for a detailed analysis of this procedure.

employers. It is unlikely that this variable is endogenous as the allocation decision which controls the number of inspectors in each province is not based on previous compliance levels (DoL, 2011). Instead the responses from IES officials indicate that inspector allocation is based solely on the number of employers in each province.

Building on theoretical work by Basu, Chau and Kanbur (2007) who develop a model of partial compliance, and Bhorat et al. (2012), who develop an 'index of violation', I examine changes in the depth of violation. Here the aim is to capture the spectrum of compliance which assumes that employers do not simply choose to comply or not to comply. Rather they can be expected to decide on how much to comply based on personal utility functions and a range of external factors. The data shows evidence of wages that have increased due to the law, but not all the way up to the level of the minimum.

The index of violation is a measure of noncompliance analogous to the Foster-Greer-Thorbecke (FGT) (1984) measure of poverty[26]. It is similarly decomposable and not only measures the number of workers who earn below the minimum but can be used to account for the depth of violation i.e. how far below the minimum each individual's wage is. For example, if the minimum wage is R800, an individual earning R799 and an individual earning R199 are both earning sub-minimum wages but the depth of violation is vastly different. The index of violation takes this into account and treats the minimum wage as the poverty line in the FGT measure.

More formally the index of violation for the agricultural industry is constructed as follows[27]:

, (5)

where is the official minimum wage for farmworkers in a given year, and captures farmworker wages for each worker. When =0 this is simply a 'headcount index' for the population which reveals the proportion of workers earning below the minimum. When =1 the violation function is a measure of the gap between farmworker wages and the minimum wage. When =2 becomes the squared gap and gives more weight to wages that fall further below the minimum. The violation gap (V1) and squared violation gap (V2) are used to examine the changing nature of violation in the post-law period. Along with kernel density plots I employ a simple Ordinary Least Squares (OLS) regression with as a dependent variable to examine changes in the post-law period.

If formal enforcement appears to have no effect on compliance there are a number of possible conclusions. On one hand, the proxies for enforcement may be poor and unable to pick up the

[26] The Foster-Greer-Thorbecke (FGT) class of poverty measures can be expressed as follows:

For $\alpha \geq 0$ where z is the poverty line, yi is the standard of living, g indicator of the ith household, and α is the 'aversion to poverty' parameter. The higher the value of α, the more sensitive the measure is to the well-being of the poorest person. The headcount index is obtained by setting $\alpha=0$, the poverty gap by setting $\alpha=1$. Setting $\alpha=2$ gives the squared poverty gap.

[27] See Bhorat et al (2010: 3) for a more detailed discussion.

effects of formal enforcement. This is plausible but unfortunately there are currently no other data available which can be used to capture enforcement effectively. It may be that compliance is not responding to formal enforcement. Employers could instead be adjusting wages due to some sense of fairness in wage setting where the minimum wage has redefined the wage floor. Another possibility is that peer effects – where one employer's decision influences other employers in the area, may play a role. Particularly if there is a limited pool of seasonal labour, the effect of one employer's choice to comply may have the effect of forcing others to follow suit. This would be necessary to avoid employee dissatisfaction, low productivity of workers, or even a drop in the availability of labour in the short term. Such an outcome would depend on how effectively employers collude and communicate. Unfortunately this is an untestable hypothesis without detailed panel data. A further hypothesis, which is tested in Section 5, is that the threat of formal enforcement is simply not credible for the typical employer.

4 Descriptive Statistics and Econometric Results

Despite contributing less than three percent to Gross Domestic Product (GDP) between 2000 and 2007 agriculture remains foundational for the South African economy in many respects and accounts for almost ten percent of formal employment (StatsSA, 2008). A major purpose of the agricultural Sectoral Determination was to provide protection for workers in a sector which is poorly unionised and reports the lowest average wages in the country. In addition to setting a legal wage floor, the new law also outlines terms and conditions of employment for the farming sector which include maximum working hours and the establishment of a written employment contract for employees. The Sectoral Determination was published on the 2nd of December 2002 and came into effect on the 16th of December 2002[28]. Provisions related to the minimum wage, however, only came into effect on the 1st of March 2003. September 2003 is treated as the first wave where the impacts of the law should be evident. Two separate wage levels are prescribed for full-time farmworkers, according to geographic location: a higher minimum wage for those working within urbanised municipal areas (Area A) and a lower wage for predominantly rural areas (Area B)[29]. In March 2003 when the law was introduced these were, R800 and R600 per month, respectively. The minimum wage is regularly updated for inflation through a formal government gazetting process which is publicly available on the Department of Labour's (DoL) website (See Appendix Table 2). These minima were set relatively high upon introduction .cutting at around the 70th percentile of the wage distribution in both cases.

The introduction of minimum wages appears to have had some immediate and substantial effects for the farmworkers covered by the law. Table 1 provides an overview of workers in

[28] The initial legislation for the farming sector was outlined in Sectoral Determination 8 and then later updated by Sectoral Determination 13 (Department of Labour; 2002, 2006).

[29] This demarcation was based on the average household income recorded for the municipal area concerned in the 1996 census, where:

A. Average income greater than R24, 000 per annum
B. Average income between R12, 000 and R24, 000 per annum.

Since 2009 this distinction between areas has been removed.

the agricultural sector by presenting key features of the sample over time. The typical demographic of a farmworker in South Africa is clear. Most individuals in the sample are African, male, have few years of education (less than six), and are engaged in full-time employment. Table 2 provides an equivalent set of data for the chosen control group. The similarities of this group are immediately evident. These workers are also typically African, male, have between seven and eight years of education, and work full time. The descriptive statistics in this section offer interesting preliminary results which shed light on the average impact of the law. Specifically I focus on the changes in employment, farmworker wages, contract coverage, and hours worked. Complementing the descriptive statistics are results from the statistical analyses. These results provide further weight to the initial findings and allow a more careful exploration of the observed changes. In particular, the use of difference-in-differences regressions link observed changes in the variables of interest directly to the introduction of the law.

4.1 Descriptive Statistics

Considering the first row of Table 1 it is evident that the number of farm workers sampled in each wave remains relatively stable over the period. This is reassuring and should increase the reliability of the weighted estimates. Changes in employment are the first area of interest. The proportionally weighted sample in row two uses the new weights calculated by Branson (2009) and provides an estimate of the number of farmworkers employed in South Africa. This sample only includes those workers who are covered by the law according to LFS classifications. The figures in Table 1 show that the number of farmworkers falls by almost 200 000 between Sept. 2002 and Sept. 2003, which is a decrease of over 20 percent. Table 2 provides comparable data on the change in the number of workers in the control group, where a gradual increase in employment can be observed. This gives an initial indication that farmworker employment fell as a result of the law. To examine the change graphically Figure 1 plots the weighted number of workers in each group over the period and shows that employment in the control group rises steadily over time while farmworker employment starts falling in March 2003 (the law was announced in December 2002) and does not recover. To rule out the possibility that this decrease may have been driven by economic conditions in the agricultural sector Table 3 details average growth levels over the period. The growth in agricultural Gross Domestic Product (GDP) was approximately one percent and thus while employment losses may have come from increased capitalisation of farming activities it is implausible that the sector was forced to shed jobs due to contracting output.

Another possibility is that these employment losses were driven by particular conditions facing certain areas of South Africa. Figure 2 plots the farmworker employment data by province, and illustrates that this decrease was not exclusive to only a few provinces but that employment appears to have decreased everywhere from its pre-law levels. Notably, the Western Cape (WC) and Kwazulu Natal (KZN) have experienced the largest declines in employment. While it is difficult to attribute the overall decrease in farmworker employment entirely to the new law it is telling that employment continues to remain at this lower level after September 2003. Moreover, no similar reduction is evident in the control group over the period. Table 4 decomposes the employment data by gender in order to examine whether

male and female farmworkers experienced similar changes. The data reveals that employment shares for males and females remain fairly stable over the period.

A second area of interest is the average wage response to the introduction of the law. Rows nine and ten in Table 1 present monthly and hourly wages for farmworkers; Table 2 presents equivalent data for the control group. From Table 1 it is immediately clear that farmworker wages are extremely low. This does suggest that the law is well-targeted. Examining changes in the wage data over time one can observe that monthly wages and hourly wages rise sharply within six months of the law coming into effect, by R173 and R1.00 respectively. Importantly, this wage spike immediately after the introduction of the law is not evident in the wages of the control group. However, given that the level of variation in wages is large, average figures cannot offer evidence of changes with a high degree of confidence. Analysing wage data by province does provide a more precise picture of the changes, as does applying a log transformation. Figure 3 presents the log of hourly wages for each province and here the increase in wages is evident for all provinces. A striking result from this figure is the compression of wages among provinces in the post-law period which is typically observed in response to minimum wage laws that are binding. The provinces where average wages increase most are those where prior to the law wages were lowest, e.g.: The Free State and Limpopo. This suggests that many employers at the low end of the distribution – from whom the minimum wage legislation required the largest adjustments – are responding to the law. In order to more accurately evaluate these changes kernel density plots of hourly and monthly wage are presented for farmworkers and the control group.

Figures 4, 5, 6 and 7 contain kernel density plots of wages for September 2001 – September 2007. Each line is a smoothed plot of the log of real wages (either hourly or monthly). The figures use data from the September waves of the LFS and therefore include two waves before the law's introduction and five thereafter. The vertical red line represents the full-time urban minimum wage in 2007. Figures 4 and 6 present hourly and monthly farmworker earnings, respectively. In the pre-law period (shown by the black and grey lines) there is no evidence that earnings are shifting in real terms; in fact the 2001 distribution is slightly to the right of the distribution in 2002 suggesting a slight decline in real earnings. However, the distribution shifts noticeably to the right in September 2003, ten months after the announcement of the law. The distribution then gradually moves to the right for all of the post-law years, with the final wave being most pronounced. Testing for distributional differences using the Kolmogorov-Smirnov tests shows that each of the post-law distributions is significantly different from those before the law was introduced, at the 5 percent level.

Figures 5 and 7 plot the distribution of real hourly and monthly wages, respectively, for the control group. The kernel density plots suggest that no significant changes in wages have occurred for the control group over the period. Testing for this statistically using the Kolmogorov-Smirnov test confirms that none of the post-law distributions are significantly different from the distributions in the period prior to the introduction of the law. As a comparison with the wage increases experienced by farmworkers these figures suggest that the law had an observable and substantial impact in the agricultural sector. Table 4, which provides information of average wages by gender, shows that this impact was experienced by

both sexes. It is also clear that on average male farmworkers earn considerably more than their female counterparts[30].

The third variable of interest in this study is the existence of a formal employment contract for farmworkers. Establishing such a contract was mandated by the Sectoral Determination and can be observed in the data. The variable to be examined is based on a response to the question, 'Do you have a written employment contract with your employer?' and goes some way to identifying if the Sectoral Determination provided real benefits for farmworkers. This is an important question, especially given the difficulty of identifying changes in non-pecuniary benefits over time; the worry being that while wages have clearly increased this increase may have to some extent been a reallocation of non-monetary payments. The establishment of a written contract which includes agreements regarding payment, hours of work, overtime pay, and leave, can be seen as an important progression for workers in an otherwise under-protected sector.

The final row of Table 1 provides information on the percentage of workers in the sector who hold such contracts. It is evident that this proportion rises considerably between September 2002 and September 2003, coverage increases by 17 percent over the 12 month period. It has almost doubled by September 2007. A significant portion of this increase appears to be a result of the legislation when the control group is used as a comparison. Although it is unclear what regulations govern the establishment of contracts for workers in the control group the timing of the increase in Table 1 is informative when compared to the gradual changes observable in Table 2. The largest increase over a 12 month period in the control group is six percent. For a vulnerable sector such as farmworkers, increased contract coverage is an important development and it appears that the Sectoral Determination has had some impact here.

The fourth and final variable of interest in this section is the number of hours worked, which could be expected to change as a result of the law. In theory employers may reduce the number of hours their employees work in order to comply with the 45 hours per week maximum set out in the Sectoral Determination, or else simply to afford the higher wage. Hamermesh (1993) argues that, 'employers are quicker to alter hours in response to shocks than they are to change levels of employment' (p. 294). Further, if employers have to increase wages due to the law they might require more productivity per hour from each worker and in this way be able to reduce hours worked. Alternatively, it is a common stylized fact that full-time workers earn more than similar part-time employees. This suggests that full-timers produce more per hour. If this is true, firms may lengthen work-weeks rather than reduce them in response to a minimum wage increase (Brown, 1999). The theoretical effect of minimum wages on hours worked is therefore ambiguous. Hertz (2005) finds that the minimum wage reduced hours of work for domestic workers in South Africa. Contradicting this Dinkelman and Ranchhod (2010) find no evidence that employers adjusted on the

[30] While this table does not control for personal characteristics a regression run with a number of personal and geographical controls reveals that on average male farmworkers earn R136 per month more than females. This regression output can be found in Table 3 of the Appendix.

intensive margin to accommodate the Sectoral Determination. Expectations as to the Agricultural Sector's response in this regard are thus unclear.

In contrast to the changes observed in employment, wages, and contract coverage, Table 1 suggests that average hours of work in the agricultural sector remained unaffected by the law. No definite trend in hours worked can be isolated from the data. Similarly, average hours worked among individuals in the control group appears relatively stable across the period. What is evident is that on average farmworkers report working more than 45 hours per week for every year. Table 4 shows that typically men work more hours per week than women. To examine the changes in hours worked more critically figure 8 plots a kernel density function. The vertical line is placed at 45 hour per week. The density plot confirms that no significant changes in hours worked have taken place over the period. This result, together with the observed changes in employment and wages, suggests that perhaps employers adjusted on the extensive margin to afford the larger wage bill and thus the law did not have an impact on the intensive margin.

4.2 Econometric Results

The econometric results present output from the difference-in-differences regressions. Changes in employment, wages, contract coverage, and hours worked are analysed statistically to explore whether the observed changes were unique to farmworkers, as well as to examine whether the minimum wage law had a greater impact in areas where wages were lower in the pre-law period. The previously specified control group is used as a comparison in this analysis, the exception being for the analysis of employment where a broader group is chosen.

In Table 5 I present the difference-in-differences results for probability of employment. The binary dependent variable is whether an individual works as a farmworker (one) or not (zero), and the second column includes controls for individual worker characteristics. The sample includes farmworkers and all demographically similar individuals who are either employed or looking for work[31]. This includes approximately 320 000 individuals across all 15 waves. Using this sample allows for farmworkers to lose or switch jobs in the post-law period. If employment has in fact fallen for farmworkers due to the law, as the descriptive data shows, then one should see a decrease in the probability of farm employment after March 2003. The results show that the probability of an individual in the sample working as a farmworker has fallen by between 13-15% in the period after the law. Interestingly, the results indicate that the probability of agricultural employment is slightly higher in areas where the wage gap was bigger. Upon reflection this makes intuitive sense given that agricultural wages are the lowest of any sector. This could simply be picking up districts with more farmworkers and therefore lower wages. The results also show that the probability of farm employment after the law is slightly lower in areas where the wage gap was largest. The coefficients are all significant. This result, together with the descriptive data which illustrates the trends in the number of farmworkers over time, provides compelling evidence that the minimum wage has had

[31] The sample includes individuals of working age, in elementary occupations, who earn low wages, and hold education levels of no greater that matric.

observable disemployment effects in the agricultural sector. However, it must be noted that the exact size of this effect is difficult to measure in the absence of a representative panel data set.

Regarding earnings, I consider the descriptive data to be compelling evidence of a large shift in wages due to the introduction of the new law; the density plots in particular make this clear. Nevertheless, it is possible that some external factors have affected farmworker wages during the period and the results presented are coincidental. In order to isolate the effect of the law the difference-in-differences approach tests whether farm workers experienced significant changes in wages in the post-law period when compared to a similar group of workers not covered by the law (i.e. the control group). This does appear to be the case. It is also shown that districts with a higher wage gap experienced greater wage increases after the law. The results are contained in Table 6.

Column 1 compares the wage outcomes of farmworkers against wages of the control group, using equation 1, as specified in Section 3. The sample includes farmworkers and the control group, containing 90 000 observations across all waves. Results show that wages in the post-law period have risen by approximately 28%, for all workers in the sample. The farmworker dummy variable indicates that, when compared to individuals in the control group, farmworkers earn significantly lower wages. On average farmworker wages are over 50% lower than the wages earned by similar workers in other occupations; this is for the entire period. Of principal interest is the difference-in-differences estimator which reveals how much wages have risen for farmworkers in the post-law period relative to those in the control group. The output shows that the estimated effect of the law on farmworker wages was an increase of 17.6%. This outcome controls for the difference between the two groups as well as possible biases coming from trends over time.

The output in columns two and three use the approach outlined in equation 2 (Section 3) to see whether the wage increases for farmworkers were larger in districts where the wage gap was greater. Column 3 includes controls for education, age, and race. The pre-law wage gap is defined so that districts with lower farmworker wages (relative to the wage of the control group) result in a bigger wage gap. Examining the output one can see that an increase in wages of between 34-38% is evident in the post-law period. The results in column 1 revealed that approximately half of this increase (17%) can be attributed to the law. Inspecting the wage gap coefficients it is clear that farmworker wages are lower in districts where the gap is bigger. The coefficient on is large, significant and positive in both specifications. This suggests that areas with a bigger wage gap in the pre-law period saw greater increases in earnings after the law was introduced. Overall these are interesting findings; not only have farmworker wages risen in the post-law period relative to counterparts in other occupations, they have risen significantly more in District Councils where the gap between the control and treatment group wage was larger. Figure 3 supports this finding at the provincial level by showing that provinces with lower wages in the pre-law period generally exhibit larger wage responses.

Regarding contract coverage the difference-in-differences output clearly confirms the pattern observed in the descriptive statistics. Table 7 presents the same set of regressions as for wages, where column 1 is based on equation 1 and columns 2 and 3 are produced by equation 2. The dependent variable is whether an individual has a written employment contract or not. Column 1 shows a 12 percentage point increase in the fraction of farmworkers and control group workers who hold a written contract after the law, so contract coverage appears to have increased for both groups. It is also clear from the results that fewer farmworkers have written contracts than their counterparts in the control group (around 17% less). The interaction term is again of leading interest and indicates that employment contracts increased by 15.6% for farmworkers in the post-law period. Columns 2 and 3, which focus exclusively on the sample of farmworkers, also point out large and significant growth in contract coverage after the law. Additionally, these regressions show that districts with a larger wage gap in the pre-law period have fewer individuals with contracts, but that coverage increased by more in these areas after the law. These econometric results demonstrate that the formalisation of employment for farmworkers, from the point of contract coverage, has been positively affected by the legislation.

Lastly, Table 8 presents results from the regression analysis on changes in hours worked from 2000-2007. The same set of three regressions is run. None of the coefficients are statistically different from zero. The exception is the farmworker dummy variable in column 1 which simply shows that on average across all waves farmworkers work 1.6 hours more than their control group counterparts. The fact that no significant changes in hours worked are evident for farmworkers confirms what was seen in Table 1 and in figure 8 – the density function. It is possible that measurement error in reporting hours of work may have biased these results. However, apart from this possibility there is no statistical evidence indicating that employers have adjusted average hours of work to accommodate the large wage increases.

5 Enforcement and Compliance in South Africa

5.1 Overview

The notion that the statutory minimum wage is also the actual minimum wage assumes that employers comply fully with the law. In South Africa, as elsewhere, this is not the case. Data on compliance in Table 1 shows that over 50% of farmworkers received sub-minimum wages in 2007. This finding establishes the quantitative significance of noncompliance, an issue which is generally more prevalent in sectors with large proportions of unskilled workers. Bhorat et al (2012) show that together with workers in the Security sector farmworkers are the most violated workers in South Africa. As in the case of other laws which conflict with the self-interest of the individual or firm, enforcement is necessary to ensure compliance. Regarding labour regulations this enforcement usually takes the form of inspections and penalties. A short description of the South African process follows[32].

[32] This description is based on Provincial Inspection Plans, information regarding inspections contained in the BCEA, Personal Interviews, an ILO (2010) report, and a presentation at the Western Cape DoL.

In South Africa the parties involved in the enforcement process are: government agencies, bargaining councils, trade unions, and other worker rights groups. Enforcement of the Agricultural Sectoral Determination, however, is governed solely by the DoL. More specifically the work is carried out by the Inspection and Enforcement Services (IES) unit within the DoL. No bargaining council exists in the agricultural sector to assist with enforcement activities and, in addition, the LFS reveals that unionisation among farm workers is close to zero. Provincial IES units are contained within the provincial DoL and produce a detailed enforcement framework which guides their enforcement activities. The IES units try to ensure compliance through a combination of inspections, investigations, advocacy sessions, and training programmes (DoL, 2011; Provincial Inspection Plan, 2010). Each provincial unit is also given an annual inspection target, handed down from the national level, which they must meet. For example, the Western Cape was scheduled to complete 11 912 inspections in 2010 across all sectors (Provincial Inspection Plan, 2010). A budget for each province is nationally determined and based upon this the provincial IES offices decide on the number of inspectors they can employ. These inspectors are allocated to Labour Centres which are geographically dispersed across the province[33]. On average, for each five labour inspectors there is one team leader who coordinates their tasks and occasionally engages in inspection work (Provincial Inspection Plan, 2010).

The core activities of a labour inspector are to visit employers in a particular sector and assess whether the applicable labour laws are being upheld, this includes laws outlined in the Sectoral Determination, Employment Equity legislation, as well as Occupational Health and Safety regulations. Inspections are both pro-active and re-active in nature. Pro-active inspections are planned in advance, either provincially or nationally. These are full audits of a sample of employers within a specific sector. Reactive inspections are conducted in response to complaints lodged at a Labour Centre and are thus specific to a single employer. Chapter 10 of the Basic Conditions of Employment Act (BCEA) of 1997 details the appointment of labour inspectors, their duties, as well as the limitations of their power. The proceedings of an inspection are outlined in each province's Provincial Inspection Plan and in the case of a reactive inspection ideally proceed as follows[34]: The inspector makes an appointment with the employer, making clear the documents the employer must produce to be inspected. A visit is made to the workplace where the inspector scrutinises the required documents (i.e. employment contracts, payslips etc.) and interviews employees. If violations are uncovered the employer is given a written undertaking which details the specifics of the violation and a date by which this must be rectified. A follow-up visit is arranged where the inspector checks whether the required changes have been made. If noncompliance persists the employer is served with a written compliance order and has 21 days to comply. Should the employer fail to do so within the allotted time, the inspector opens a case with the Labour Court and serves the employer a Notice of Motion. The case proceeds to the Labour Court.

Two major problems with the efficacy of the enforcement process are noticeable. These were also emphasised in focus group discussions with inspectors and team leaders, as well as in

[33] A list of Labour Centres is available online from www.labour.gov.za.
[34] Proactive inspections are procedurally similar but involve a more detailed audit of all employer activities.

interviews with provincial IES officials. Firstly, concerning the penalties for violation, inspectors do not have the power to issue spot fines. Monetary penalties for violation of the law only come into force once a case of has been decided in the Labour Court and the employer found guilty. Importantly, the penalties imposed on noncompliant employers at this stage are relatively small[35]. Furthermore, in a case of underpayment, the maximum period for which employers can be held liable to repay wages owed, is one year. Taken together this suggests that financial deterrents against noncompliance are weak. The second concern follows from the first and relates to the time taken for a complaint to move from initial inspection to resolution in a Labour Court. Anecdotal evidence from inspector interviews suggest that cases can take years to settle, by which time employees have often relocated and employers may have shut down or moved elsewhere. Additional evidence from a recent International Labour Organisation report also suggests that the time taken to resolve cases is problematic (ILO, 2009). Finally the ILO's website contains information on South African labour law and emphasises that the Labour Courts are slow[36]. Together, the minimal penalties and inefficiency of the prosecution process for offenders supports the notion that in reality employers do not face large deterrents against violating labour laws. Thus, one could expect that regardless of how motivated and active a team of inspectors may be, such efforts do little to encourage compliance when the correct incentives do not exist. This will be examined in Section 5.4.

5.2 Descriptive Statistics

Despite the situation described above large increases in wages suggest that a significant proportion of employers have begun to pay higher wages in the post law period. Of interest is whether work undertaken by the IES has played a role in this. There has been discussion attributing variation in noncompliance across different areas, to the number of inspectors present (Bhorat et al, 2012). Limited data on the inspectorate, however, has rendered this a difficult proposition to test empirically. Figure 4 illustrates that compliance does differ significantly across provinces, this variation is even more apparent when district-level compliance is analysed. However, this variation may be driven by a number of factors. For example one might suspect that employers in wealthier areas can afford to pay higher wages. Provinces such as the Western Cape and Gauteng have the highest wages (See Figure 3) and thus wages do not have to increase by much to achieve compliance with the minimum. This can be seen in when looking at Figure 3 and Figure 4 together. Compliance rates rise sharply for both provinces despite the fact that wages in these provinces did not increase much from pre-law levels relative to provinces such as Limpopo. Other factors which may influence compliance are discussed shortly.

From Table 1 it is evident that the fraction of workers paid below the minimum wage decreases over 80% in September 2000 to around 60% in the final wave of the data. Thus more than half of farmworkers report earning wages below the prescribed minimum in 2007. The relatively low levels of compliance imply that any observed impacts of the law should be seen as a lower bound – these impacts would increase with greater levels of compliance. It is

[35] See Table A4 in the Appendix for the Maximum Permissible Fines.
[36] http://www.ilo.org/public/english/dialogue/ifpdial/info/national/sa.htm

plausible that the government initially accepts low levels of compliance and has therefore not committed substantial resources to enforcement[37]. This could be a rational planning decision given the high levels of unemployment in South Africa and the fact that greater disemployment effects would result from stricter enforcement[38]. However, given that the IES does engage in numerous enforcement activities to try and ensure compliance, it is plausible that these formal enforcement efforts have had some observable influence on compliance. This is the hypothesis I aim to test in the following section.

5.3 The Effect of Enforcement

This section tests for the influence of enforcement on the rise in farmworker wages. To analyse the effect of enforcement I apply the difference-in-differences regression shown in equation 3 of Section 3. The variable used by Bhorat et al (2012) as a proxy for formal enforcement is the number of labour inspectors per province. There are obvious problems with using such a blunt measure, not least of all the fact that left un-weighted the number of inspectors does not account for the number of employers among which inspectors have to allocate their efforts. In a study of enforcement in Brazil Ronconi (2008) uses the number of inspectors per capita, which appears to be better measure in this regard. Dinkelman and Ranchhod (2010) use the presence of a Labour Centre at the Magisterial District level as a proxy for enforcement. This measure is problematic because of the small sample size within each Magisterial District. I therefore follow Ronconi (2008) and use the weighted number of labour inspectors per province, and then also use the presence of a Labour Centre coded at the District Council level[39]. The reason that Labour Centres are a useful proxy for enforcement is that they house the Labour Inspectors and are the place where employee complaints regarding noncompliance are lodged.

The total number of labour inspectors per province is presented in Figure 5. There is clearly some variation in the number of inspectors per province, and it will be tested whether there is a statistical relationship between the number of inspectors per worker and compliance levels over time. Since inspectors are allocated provincially a more disaggregated measure is not available, unfortunately this prevents taking account of the variation across districts. A larger inspector presence at the provincial level should increase the probability of being inspected. As should a greater Labour Centre presence in each District Council. At least, one might expect that inspectors and Labour Centres should influence employer beliefs about the chance of being monitored. While the number of inspectors per province is still a relatively blunt measure it serves as an initial exploration into enforcement in South Africa. The use of Labour Centres at the District Council level allows for a more disaggregated measure of enforcement.

[37] Interviews in the Western Cape reveal a severe lack of resources in the IES; this is supported by the ILO (2010) report. In particular, inspectors are poorly remunerated and Labour Centres are underequipped with computers and vehicles.

[38] See Basu, Chau and Kanbur (2010) for a model which shows that partial compliance can be an equilibrium outcome.

[39] The distribution of Labour Centres is shown in the Appendix, Table A1.

Table 9 presents the results. The first three columns have inspectors as the enforcement proxy while the last three use Labour Centres. In each case the final column includes a triple interaction term or difference-in-differences-in-differences. The increase in wages is still evident on the POST coefficient for all specifications, which confirms that wages have risen after the law. Analysing the results it is clear that enforcement has not had a large effect on the wage increase. The effect of inspectors shows up as either insignificant or of negligible size in all three equations. A significant and positive coefficient on
suggests that in the post-law period a greater number of inspectors is related to higher wages, however, the size of the coefficient is negligible. Column three includes the triple interaction between inspectors, the wage gap, and the time dummy. Here the sign is what one would expect – a positive effect in the post period for provinces with more inspectors and a higher wage gap. But again the size is trivial. Using the number of Labour Centre's in each District Council does not appear to uncover impacts that may have been passed over at the provincial level. The coefficient reports that there is no correlation between rising wages and the presence of a labour centre. Again the triple interaction term is of the expected sign but not significantly different from zero.

Overall the data shows that the number of labour inspectors and the presence of a Labour Centre had no significant influence on the change in farmworker wages after the law. While these proxies for enforcement may be poor the results do provide a sense of the effect that formal mechanisms have had in this sector, which appears negligible. In addition I test whether inspectors may have had a lagged effect on compliance, i.e. whether the number of inspectors this year impacts on compliance levels in the following year; this does not change the results. Based on the evidence provided, employers seem not to be influenced by existing government enforcement.

5.4 A Theoretical Model of Compliance

Returning to the theoretical literature on enforcement it is possible to analyse compliance incentives facing employers in order to gain insight into observed employer behaviour. The results of this enquiry help to make sense of the high levels of noncompliance and the fact that current enforcement efforts have had no observable impact. The Ashenfelter and Smith (1979) equation was outlined in Section 1 (see footnote 11) and shows that when considering the trade-off between compliance and noncompliance a profit maximising employer will not comply if the expected benefit from paying sub-minimum wages exceeds the expected penalty. This equation can be rearranged and stated formally:

– (6)[40]

A rational employer will choose to violate if the left hand side (LHS) of the equation exceeds the right hand side (RHS). The expected benefit of not complying (LHS) is the chance of not being detected multiplied by the total labour costs saved by paying workers below

[40] See Ashenfelter and Smith (1979) for a full derivation of the LHS of equation (4), and Chang and Erlich (1985) for an extension of the penalty structure (RHS). Weil (2005) provides a simple empirical application of the Ashenfelter and Smith (1979) theory. I modify the RHS, this is explained in the text.

the legal minimum. The expected penalty (RHS) is the probability of being caught ( ) multiplied by the price that each firm must pay for their crime. Here I make two adjustments to the typical models found in the literature on how the penalty is modelled. Generally the theoretical literature specifies the cost of violation either as a fixed penalty (as in Ashenfelter and Smith, 1979) or some proportion of the back wages owed (as in Grenier, 1982, and Chang and Erlich, 1985). However, in the South African setting a noncompliant employer not only has to pay a penalty for violation (this is a percentage of the back wages owed[41]), but must also obviously correct his fault and pay employees what they are owed. The latter cost does not appear in previous models of compliance. Thus the full penalty in equation 4 is some percentage ( ) of the back wages owed plus the back wages themselves, for each employee . In addition, due to the long delays found in the South African Labour Courts I include a discounting factor which allows employers to evaluate the expected penalty at some future date based on an annual interest rate and years.

Clearly from equation 6 one can see that the benefit of noncompliance increases with underpayment, but so does the possible penalty. The equation also shows that there are three employer-related characteristics which increase the incentive to violate (i.e. pay sub-minimum wages): firstly, if market wages are far below the legal minimum employers stand to profit more from violation, secondly, if there is a greater absolute value of the elasticity of labour demand (, and thirdly, certain employer-specific features which may decrease inspection probability. On the contrary the enforcement agency can increase the incentives to comply by either raising the probability of detection ( ) or increasing the penalties for violation.

Based on data gathered from the IES in the Western Cape for 2007 this equation can be roughly estimated. Given that the Western Cape has the highest average wages and lowest levels of violation this should be seen as the best case scenario in South Africa. It is possible that the incentives in other provinces may be slightly different; Table 10 offers a relatively simple scenario analysis showing how changes in key variables affect the employer's cost-benefit calculation. The average monthly underpayment ( ) in the agricultural industry in the Western Cape is R144, this is calculated for those workers who earn less than the minimum wage in 2007. The average probability of inspection in the province is 0.11. I arrive at this figure by dividing the number of agricultural inspections carried out by the Western Cape IES for 2007 by the number of farms in the province[42]. This provides a rough estimate of each employer's chance of being inspected by the DoL. I assume a labour demand elasticity of -1.3 based on (Sparrow, Ortmann, Lyne and Darroch, 2008). The penalty is calculated for first-time offenders (25% of underpayment) and the discount factor is based on an annual average interest rate of 13% for 2007 and a period of 1.5 years[43]. In this scenario the potential annual cost of noncompliance for a typical employer in the Western Cape is R2 658. The annual economic benefit of paying sub-minimum wages is R 20 659. This implies

[41] This percentage depends on the number of previous violations – detailed in the penalty schedule (Table A4).
[42] The number of Commercial Farms is taken from the Census of Commercial Agriculture, 2007, StatsSA, 2008.
[43] The interest rate is the average for 2007 from the South African Reserve Bank – www.sarb.gov.za – while the average time for a court case is a rough average based on ILO reports and interview data.

that profit maximising farmers should rationally choose not to comply with the minimum wage law. This conclusion helps to explain the high levels of noncompliance observed in the LFS data which is based on self-reported wage data. Data from the Western Cape IES for 2007 supports this by showing that inspections in the agricultural sector found approximately 50% compliance with the Sectoral Determination. The theoretical model provides clear insight into the rationale behind the noncompliant employer's choice.

5.5 Depth of Violation

In this final section I use the index of violation defined in Section 3 to examine changes in the depth of violation among farmworkers after the Sectoral Determination came into effect. Table 1 showed that the number of workers earning sub-minimum wages in Area A and B decreased over the period, although the proportion remains high. This headcount index revealed that between 60 and 66 percent of workers were earning less than the law required in 2007. What such data does not reveal is the depth of the underpayment.

Table 11 presents the index of violation for farmworkers; this can be seen as an analogue to the FGT measures where the minimum wage is used instead of a poverty line. The ratio (V1/V0) allows for the interpretation of V1. This fraction denotes the percentage shortfall of wages for farmworkers earning below the minimum. Put differently, violated workers in this sample are earning (V1/V0) below the relevant minima on average. Clearly the depth of violation has gradually decreased over the period. The data shows that in 2007 workers who earned sub-minimum wages received wages that were 30% below the minimum on average in Area A. This figure is slightly higher at 36% in areas falling within the Area B classification. The estimates for V2, the severity of violation, in 2007 are 0.09 and 0.01 for Areas A and B, respectively. To illustrate changes in the depth of violation over time Figure 11 and Figure 12 plot kernel density functions for V1 and V2 over time. Both figures show that the depth of violation decreases significantly after 2002, suggesting that once the law came into effect the depth of violation decreased even if many farmworkers still earned sub-minimum wages. In other words, this provides evidence of partial compliance with the law.

The results of the OLS regressions are presented in Table 12. The model is estimated separately for two dependent variables which represent the depth of violation; firstly the violation gap (V1) and secondly the violation gap squared (V2). Each specification is run with and without controls. Columns 2 and 4 include controls for race, age and education. All of the coefficients on the variable are significant. This shows that the depth of violation has decreased substantially in the post-law period. V1 has decreased by 13% in the post-law period while V2 fell by 9%. These results underscore the trends evident in Table 10 as well as the changing distributions presented in figures 11 and 12. This simple investigation of changes in the depth of violation serves to illustrate is how the agricultural sector has responded to the law. Evidence suggests that while levels of violation remain above 50% many employers do not simply decide to comply or violate, but instead choose whether and how much to comply. Analysing changes across the distribution of violated workers showed that partial compliance has occurred. Many farmworkers who earn sub-minimum wages have experienced wage increases but not all the way up to the minimum.

6 Conclusions and Discussion

Studying the impact of the introducing minimum wage and employment legislation into a vulnerable, low-wage sector is an important. It holds relevant information for policymakers and also provides an example of the response of a specific sector to minimum wage laws. In addition, this paper's analysis of enforcement and compliance offers insight into employer behaviour in a sector with high levels of noncompliance – in particular, employer response to the presence of formal enforcement.

Despite non-threatening levels of enforcement it appears that the Sectoral Determination had significant effects. Hence, farmworker wages rose by approximately 17% as a result of the law. Examining the difference-in-difference results it was also clear that wages rose by more in districts where the wage gap, between farmworker wages and control group wages, was higher. In other words, districts where farmworker wages were far below the median wages of similar workers experienced greater wage increases. This was evident despite the fact that approximately 60% of farmworkers still received sub-minimum wages in 2007. Regarding non-monetary impacts, the law also substantially increased contract coverage for farmworkers in South Africa. Encouragingly, the number of workers with a written employment contract increased to reach 57% in 2007.

In examining the effect that the minimum wage had on employment, this paper shows that while no adjustments on the intensive margin were observed the data suggest that employment has fallen in response to the law. This was evident in the descriptive statistics, particularly when employment changes are compared to those experienced by the control group. Additionally the probability of employment as a farmworker was shown to have fallen by approximately 13% in the post-law period. Given that the law mandated minimum wages which cut at the 70th percentile of the wage distribution in 2003 it is perhaps not surprising that some disemployment effects are observed. Taking the context into account such effects are largely supported by the new minimum wage literature. Neumark and Wascher (2007) emphasise that disemployment effects are more likely when aggregate data is analysed and particularly for unskilled workers.

Explaining exactly why certain employers comply with the legislation proved di¢ cult. Formal enforcement appears not to have had significant effect. This may be due to the relatively weak proxies used. Precise data on the number of inspections carried out in each area would provide a more accurate picture of how enforcement activities affect employers' compliance decisions. However, an analysis of the enforcement procedure together with a theoretical model of employer compliance highlights the lack of incentives for employers to comply with the minimum wage law. In other words, the lack of a credible threat. This is driven by a combination of the low inspection probability, relatively small fines, a high elasticity of labour demand, and an extremely slow legal procedure. Interviews with the Western Cape IES highlighted the possibility of adjustments to the status quo which could solve the problem: allowing inspectors to issue spot fines for violations, as well as criminalising the contravening of certain labour laws, were two points consistently mentioned in interviews and focus groups as better mechanisms to deter offenders and avoid the inefficient Labour Courts.

Despite the insignificant impact of enforcement and the incentives facing employers which encourage noncompliance, the observed changes in wages, employment and contract coverage suggest that some compliance has occurred. Examining changes in the depth of violation provided evidence that many employers partially complied with the law even if they did not increase wages all the way to the minimum. This was also clear in the kernel density plots of farmworker wage distributions. Moreover, the fact that the earnings distribution compressed (the variance decreased) after the law suggests that employers increased wages toward the minimum, but not above it. It is possible that peer effects played a role in causing certain employers to increase wages; however, this would be most easily tested using a set of panel data.

Perhaps a more plausible reason for the law's effectiveness could be found in models of fairness in wage-setting. Particularly since the data showed that partial compliance took place in all areas. A theoretical literature in labour economics develops the idea of a 'fair wage'. This is important for employers as it is key to inducing workers to provide high effort in settings where monitoring is difficult (Akerlof, 1982, 1984; Akerlof and Yellen, 1988). In the South African case, it is plausible that the announcement of the mini- mum wage created, or adjusted, employer conceptions of what constitutes a fair wage. This may have resulted in voluntary employer responses despite the lack of formal incentives to comply (through inspections and penalties). A study by Bhorat (2000) focusing on farmworkers and domestic workers hints at this possibility, "[A modest minimum] wage would set a first-step benchmark for good wage practice amongst employers. Indeed, such an initial minimum wage may set a positive trend, and see employers gradually increase the wages paid to these workers".(Bhorat 2000:12). The evidence of partial compliance supports the idea that employers are responding to a new wage floor. It is also possible that this partial compliance is initially accepted by the government in order to bring about real changes in outcomes in the longer term without incurring significant short run disemployment. A theoretical model of this is posited by Basu, Chau and Kanbur (2010) where the authors show that 'turning a blind eye' to a portion of minimum wage violations can constitute an equilibrium outcome.

In conclusion it must be emphasised that the inability to obtain data on the changes in non-monetary income is a limitation of this work. In addition, the lack of precise data on inspection activities inhibits the analysis of formal enforcement. This is, however, a new and significant area of research in South Africa requiring more in-depth study. Another caveat is that the data covers a relatively short period of time after the introduction of the law. In the longer term, as the agricultural sector responds to this legislation, the effects observed here may change. Future studies may find valuable insight in examining the fluctuating nature of agricultural employment to see how employers respond to the legislation over time, particularly if compliance continues to increase.

Appendix

Table A1. LFS Mapping: District Council Codes, Farm Areas, Magisterial District Codes

District Council	Farm Area	LC	Magisterial District Code
DC1	A	1	131-138
DC2	A	2	108-109, 112, 126-130
DC3	A	1	113-115, 117
DC4	A	4	116, 118-125
DC5	B	1	139-124
DC6	A	2	301-304, 325
DC7	B	1	305-314, 319, 324, 326
DC8	A	1	315-316, 323
DC9	B	1	317-318, 320-321
DC10	B	2	201, 221-222, 224, 227-228, 231-239
DC12	B	6	202, 212-213, 217 219-220, 223, 225-226, 230, 242-249, 251-252, 255-256, 265, 273
DC13	B	2	206, 208-209, 214-216, 218, 229, 253, 268, 271, 274-275,
DC14	B	1	203-205 207, 210-211 261, 276
DC15	B	2	250, 254, 257-258, 263-264, 266-267, 267-270, 272
DC16	B	2	402-405, 434, 436, 439-441, 446-449
DC17	A	2	433, 435, 437, 442, 444-445, 451
DC18	B	1	401, 406-410, 412-413, 417, 421, 431, 443
DC19	B	4	422-430, 432, 438, 452
DC20	B	3	411, 414-416 418-420 450
DC21	B	1	508, 510-511, 541
DC22	B	2	505-507, 514-515, 517-519
DC23	B	2	521-524
DC24	B	1	516, 520, 526-527, 546-547
DC25	B	1	525, 528-529
DC26	B	2	530-533, 548-549, 551
DC27	B	0	535, 539, 550
DC28	B	1	534, 536-538, 545
DC29	B	1	540, 543-544
DC30	B	8	801-808, 810-811, 824
DC31	A	6	809, 812-813, 815-817, 827-831
DC32	B	3	819-823, 825-826
DC33	B	1	913, 916-918
DC34	B	2	902, 905, 911-912, 928-931
DC35	B	2	904, 919-920, 922-923
DC36	B	3	906-910, 921
DC37	B	3	606, 615-619
DC38	B	5	605, 607-608, 613
DC39	B	0	601, 603-604, 609, 611
DC40	B	3	610, 612, 614, 716
DC42	A	4	706 712-713, 722-723
DC43	B	1	509, 512-513 513
DC44	B	0	259-260, 262, 277
CBDC1	B	1	322, 602
CBDC2	A	1	720-721
CBDC3	B	1	924-925, 814, 818
CBDC4	B	2	901, 903, 914-915, 926-927
CBDC8	A	2	715, 717, 719
Cape Town	A	4	102-107, 110-111
Port Elizabeth	A	2	204-241
Durban	A	3	501-504, 542
East Rand	A	6	707-711, 714
Johannesburg	A	4	704-705, 718, 724
Pretoria	A	3	701-703, 702, 703

Table A2. Agricultural Sectoral Determination for Areas A & B, Annually Adjusted

	Year				
Area Type	**2003**	**2004**	**2005**	**2006**	**2007**
A	R 800	R 871.58	R 949.58	R 994	R 1041
B	R 650	R 713.65	R 785.76	R 885	R 989

Table A3. OLS Regression on Farmworker Wages

VARIABLES	Log of Monthly Wages
Males	0.169***
	(0.00744)
Years of Schooling	0.0331***
	(0.00102)
African	-0.150***
	(0.0112)
Written Contract	0.336***
	(0.00691)
Western Cape	0.298***
	(0.0165)
Eastern Cape	-0.116***
	(0.0148)
Nothern Cape	0.0728***
	(0.0178)
Free State	-0.167***
	(0.0144)
Kwa-Zulu	0.0654***
	(0.0136)
North West	0.0449***
	(0.0154)
Gauteng	0.392***
	(0.0203)
Mpumalanga	0.115***
	(0.0156)
Rural	-0.0625***
	(0.00791)
Age	0.0361***
	(0.00180)
Age Squared	-0.000379***
	(2.30e-05)
Constant	5.309***
	(0.0411)
Observations	28,758
R-squared	0.275

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Limpopo is the base province.

Table A4. Maximum Permissible Fines for Violation

Maximum Permissible Fines (Schedule 2 of the BCEA, 1997)

Maximum Permissible Fine not involving underpayment	
No previous violation	R100 per employee
No previous violation in respect of the same provision of the Act	R200 per employee
A previous violation the same year or two violations in respect to the same provision during the past 3 years	R300 per employee
3 previous violations of the same provision within 3 years	R400 per employee
4 previous violations of the same provision within 3 years	R500 per employee
Maximum Permissible Fine involving underpayment	
No previous violation	25 % of the underpayment, including any interest owing on the amount at the time of the order
A previous violation of the same provision during the past 3 years	50 % of the amount due including applicable interest
A previous violation of the same provision within a year, or 2 previous violations, or 2 previous violations of the same provision	75 % of the amount due, including applicable interest
3 previous violations of the same provision during the past three years	100 % of the amount due including applicable interest
3 previous violations of the same provision during the past three years	200 % of the amount due including applicable interest

Tables and Figures

Table 1: Average Characteristics of Farmworkers (2000-2007)

	2000	2001	2002	2003	2004	2005	2006	2007
N	2 730	2 433	2 738	2 055	2 399	2 438	2 453	2 366
Weighted	805 715	804 162	819 048	623 750	538 538	515 046	513 332	553 806
Area A	0.48	0.51	0.46	0.47	0.39	0.34	0.36	0.37
Age	36	37	37	37	38	37	38	37
Education	5.50	5.42	5.34	5.54	5.45	5.82	5.94	6.03
Male	0.69	0.73	0.70	0.72	0.70	0.73	0.69	0.71
African	0.84	0.74	0.79	0.76	0.82	0.81	0.82	0.83
Full-Time	0.85	0.94	0.89	0.97	0.95	0.94	0.94	0.93
Hours per Week	46	51	48	50	49	49	48	46
Nominal Monthly Wage	630	707	684	857	920	1036	1242	1337
Nominal Hourly Wage	2.8	3.3	3.1	4.1	4.3	4.8	5.9	6.5
Fraction < Min. (Area A)	0.82	0.71	0.72	0.62	0.64	0.63	0.60	0.59
Fraction < Min. (Area B)	0.86	0.79	0.82	0.63	0.62	0.64	0.64	0.66
Written Contract	0.31	0.30	0.34	0.49	0.49	0.50	0.53	0.56

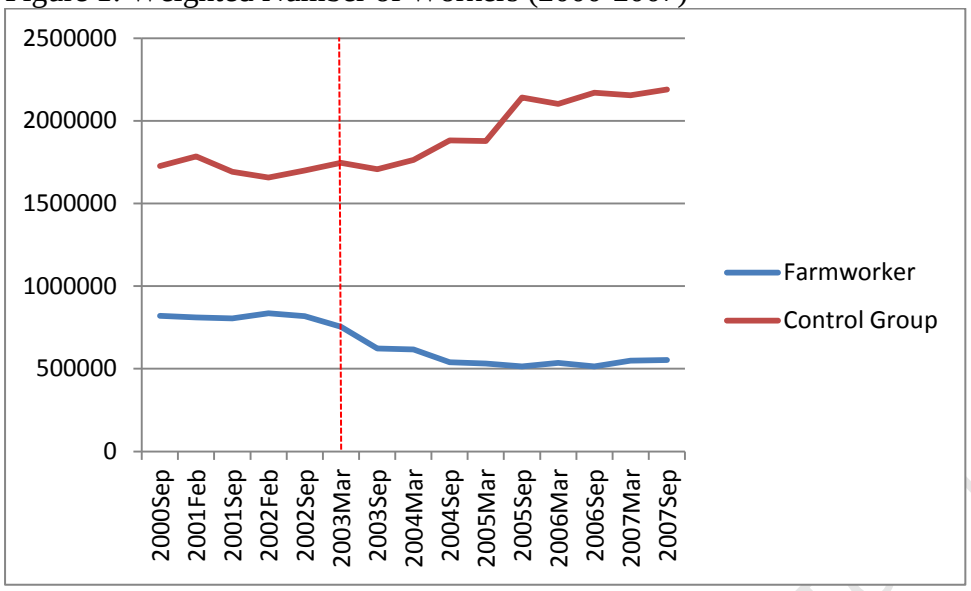
Figures are calculated from the South African Labour Force Surveys (LFS) for September 2000-September 2007. All statistics are weighted. Full time workers are those working more than 27 hours per week. The dashed red line indicates the timing of the law (March 2003). The wage variables presented are medians for full-time workers. Noncompliance before 2003 is based on the minima adjusted backwards using the formula contained in the Agricultural Sectoral Determination.

Table 2: Average Characteristics of the Control Group (2000-2007)

	2000	2001	2002	2003	2004	2005	2006	2007
N	4 121	3 773	3 603	3 379	3 781	4 455	4 456	4 228
Weighted	1 785 730	1 600 441	1 636 771	1 682 776	1 796 746	2 162 153	2 128 327	2 038 391
Area A	0.57	0.56	0.58	0.55	0.44	0.41	0.42	0.41
Age	38	41	40	40	38	44	46	41
Education	7.65	7.72	7.88	8.05	8.25	8.27	8.37	8.25
Male	0.62	0.59	0.62	0.56	0.62	0.58	0.58	0.61
African	0.83	0.85	0.84	0.85	0.84	0.86	0.85	0.86
Full-Time	0.87	0.88	0.90	0.89	0.90	0.89	0.90	0.89
Hours per Week	45	43	45	46	46	46	45	45
Mean Monthly Wage	1 321	1 210	1 307	1 367	1 441	1 492	1 736	1 961
Mean Hourly Wage	6.24	5.84	6.16	6.83	7.17	7.01	8.58	9.91
Fraction < Farm Min.*	0.34	0.37	0.33	0.30	0.33	0.36	0.32	0.28
Written Contract	0.46	0.50	0.55	0.60	0.63	0.57	0.60	0.64

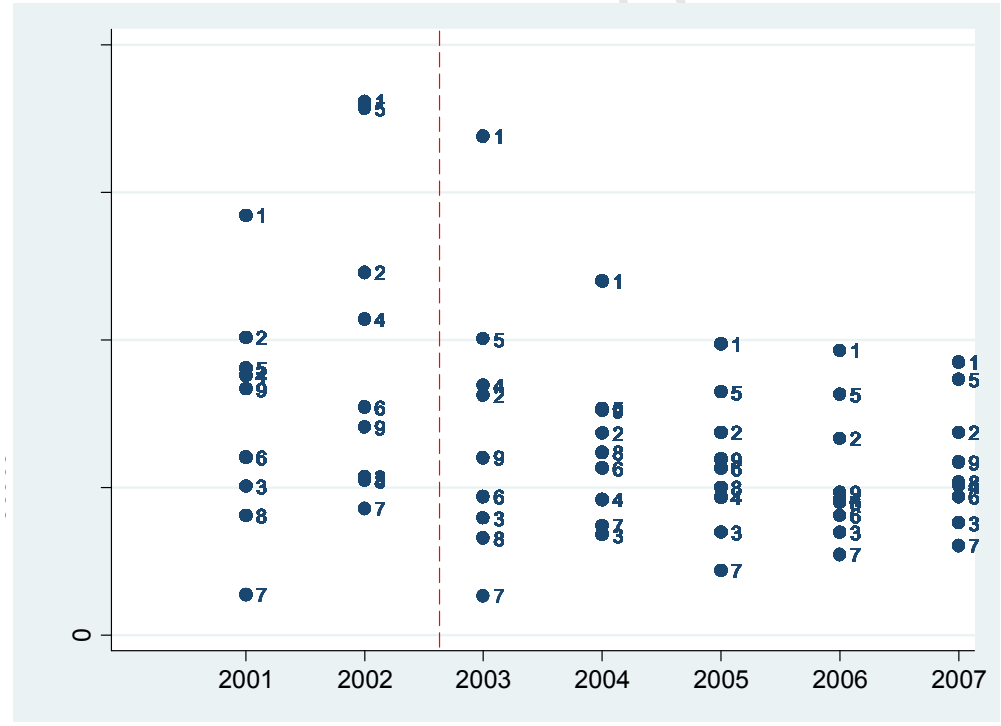
Figures are calculated from the South African Labour Force Surveys (LFS) for September 2000-September 2007. All statistics are weighted. Full time workers are those working more than 27 hours per week. The dashed red line indicates the timing of the law (March 2003). The wage variables presented are medians for full-time workers. * The minimum used is for farmworkers in Area A.

Figure 1: Weighted Number of Workers (2000-2007)



The dashed red line represents the timing of the law. Data are from September 2000 – September 2007. Farmworkers are those workers covered by the agricultural Sectoral Determination. The Control Group includes similar workers who are not covered by the minimum wage, see Section 2.

Figure 2: Weighted Number of Farmworkers, by Province (2000-2007)



The dashed red line represents the timing of the law. Provinces are coded as: 1-Western Cape (WC), 2-Eastern Cape (EC), 3-Northern Cape (NC), 4-Free State (FS), 5-Kwa-Zulu Natal (KZN), 6-North West (NW), 7-Gauteng (GTG), 8-Mpumalanga (MPM), and 9-Limpopo (LMP).

Table 3: Gross Domestic Product and Value added by Industry (Constant 2005 Prices)

	2000		2007		2000-2007
	R	Share	R	Share	Growth

	Million		Million		Rate
Primary Sectors					
Agriculture, forestry and fishing	34 787	3.0%	36 301	2.3%	1.2%
Mining and quarrying	99 069	8.6%	105 336	6.7%	0.6%
Secondary Sectors					
Manufacturing	222 579	19.2%	290 246	18.6%	4.4%
Electricity, gas and water	28 597	2.5%	35 294	2.3%	3.1%
Construction	26 410	2.3%	48 971	3.1%	8.8%
Tertiary Sectors					
Wholesale, retail, motor trade and accommodation	161 503	14.0%	217 607	13.9%	4.8%
Transport, storage and communication	102 874	8.9%	156 289	10.0%	6.4%
Finance, real estate and business services	216 747	18.7%	349 501	22.4%	6.6%
General government services	191 340	16.5%	223 618	14.3%	1.9%
Personal services	75 735	6.5%	98 247	6.3%	3.9%
Aggregate GDP	1 157 441		1 561 410		4.4%

Source: Own Calculations (StatsSA, 2011)

Table 4: Gender Composition: Nominal Earnings, Hours Worked, Employment, Contracts

Employment Share, by Gender

	2000	2001	2002	2003	2004	2005	2006	2007
Male	0.69	0.67	0.69	0.74	0.69	0.71	0.70	0.71
Female	0.31	0.33	0.31	0.26	0.31	0.29	0.30	0.29

Monthly Farmworker Wage, by Gender

	2000	2001	2002	2003	2004	2005	2006	2007
Male	615	733	801	986	1012	1035	1231	1412
Female	438	471	490	615	649	826	996	1030

% Farmworkers with Written Contracts, by Gender

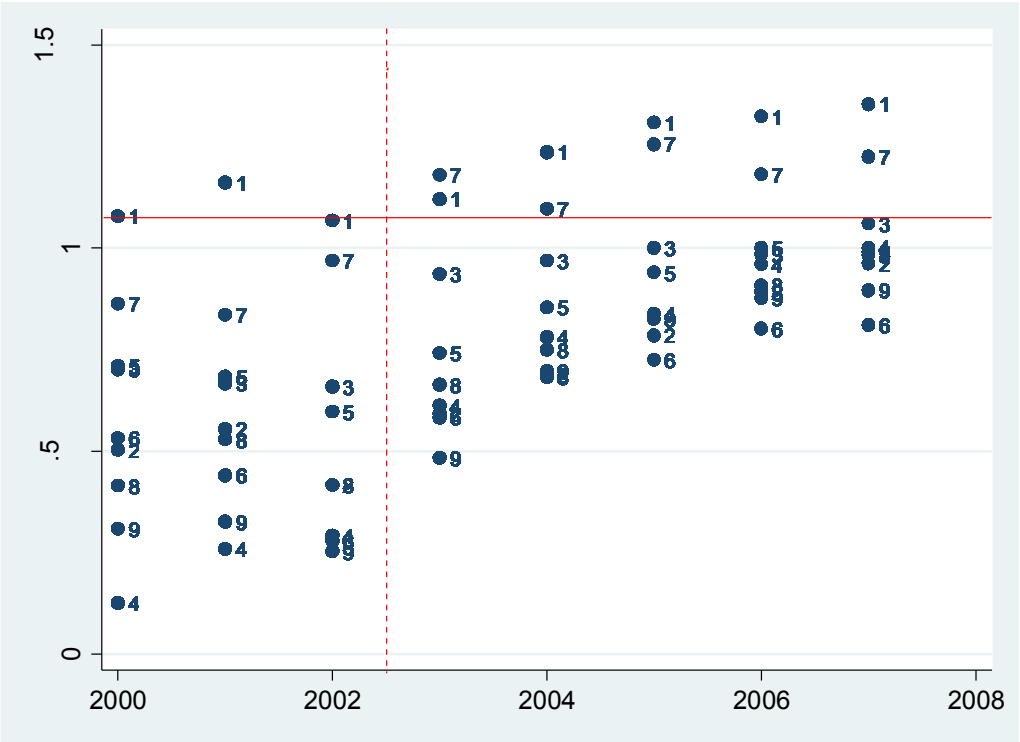
	2000	2001	2002	2003	2004	2005	2006	2007
Male	0.33	0.29	0.32	0.49	0.54	0.53	0.51	0.52
Female	0.28	0.28	0.30	0.40	0.46	0.45	0.47	0.53

Hours Worked, by Gender

	2000	2001	2002	2003	2004	2005	2006	2007
Male	48	52	50	51	51	51	50	50
Females	42	48	44	47	47	46	45	46

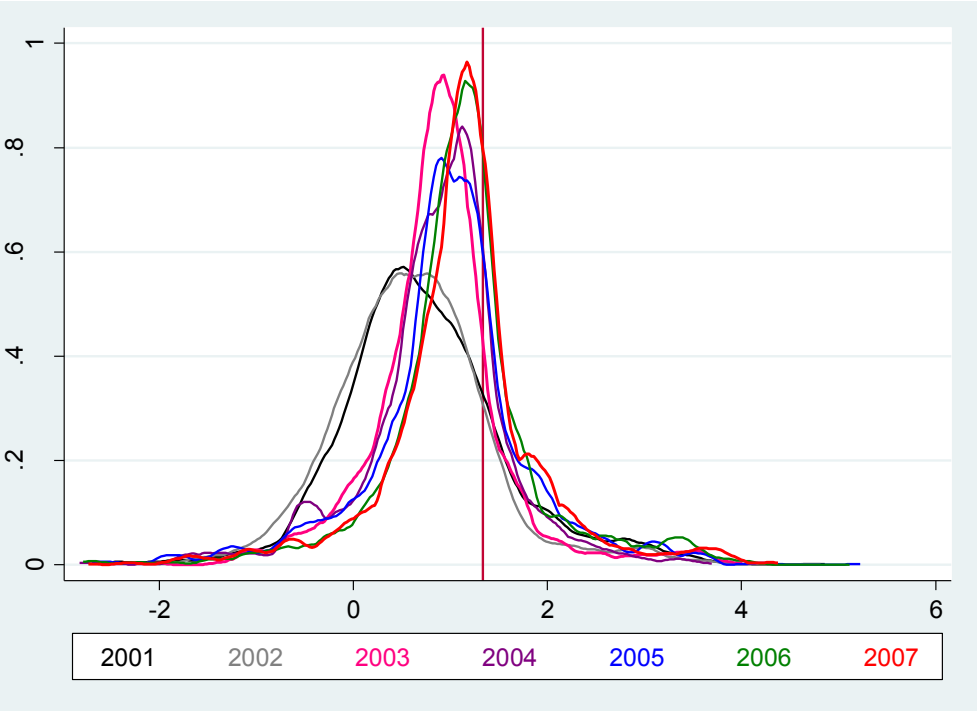
Source: Own Calculations September LFS 2000-2007.

Figure 3: Farmworker Log Real Hourly Wages per Province (2000-2007)



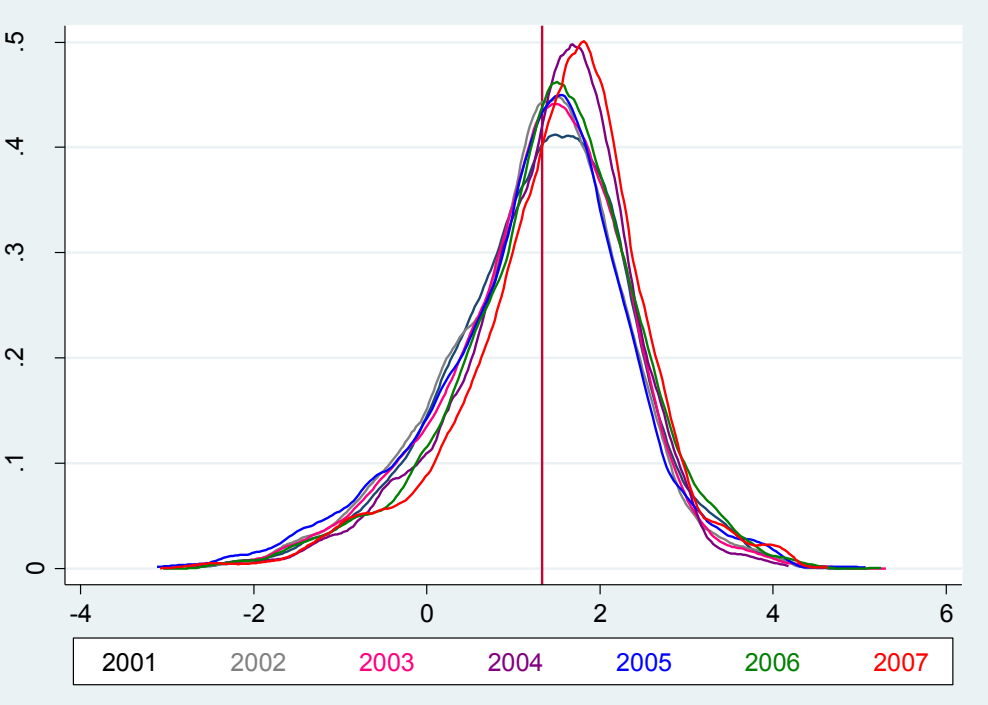
The solid red line represents the 2003 minimum wage and the dashed red line represents the timing of the law. Provinces are coded as: 1-WC, 2-EC, 3-NC, 4-FS, 5-KZN, 6-NW, 7-GTG, 8-MPM, and 9-LMP.

Figure 4: Distribution of Farmworker Log Real Hourly Wages (2001-2007)



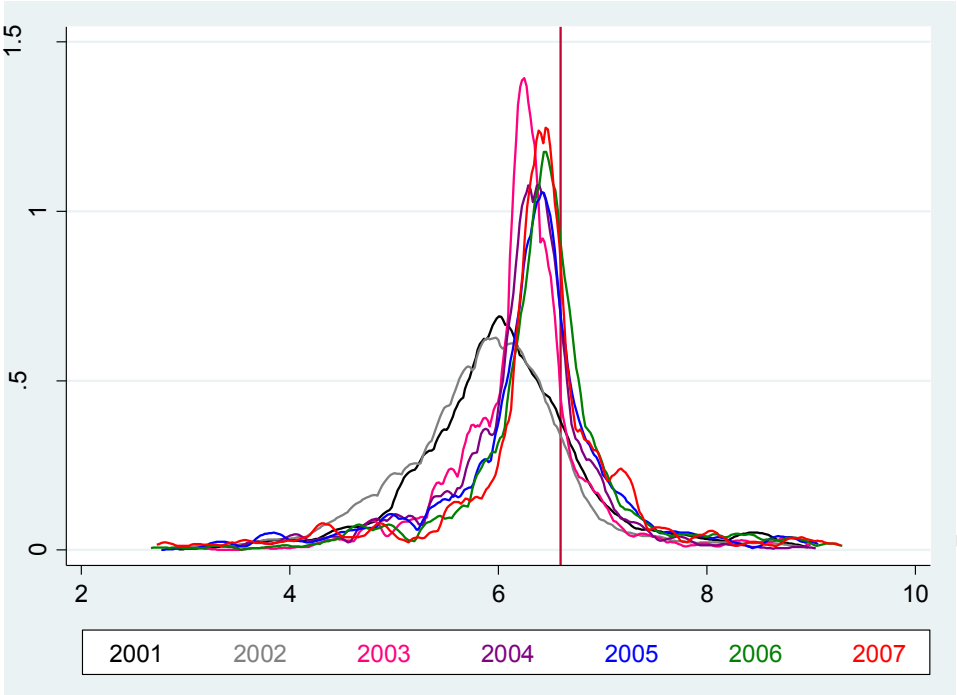
Data are from the September Waves of the LFS 2001-2007. The vertical line is the level of the full-time minimum wage in 2003. Each wave of data contains between 1811 and 2417 observations. Kolmogorov-Smirnov tests for equality of distributions are rejected at the 5% level for each pairwise comparison of waves in the before and after periods.

Figure 5: Distribution of Control Group Log Real Hourly Earnings (2001-2007)



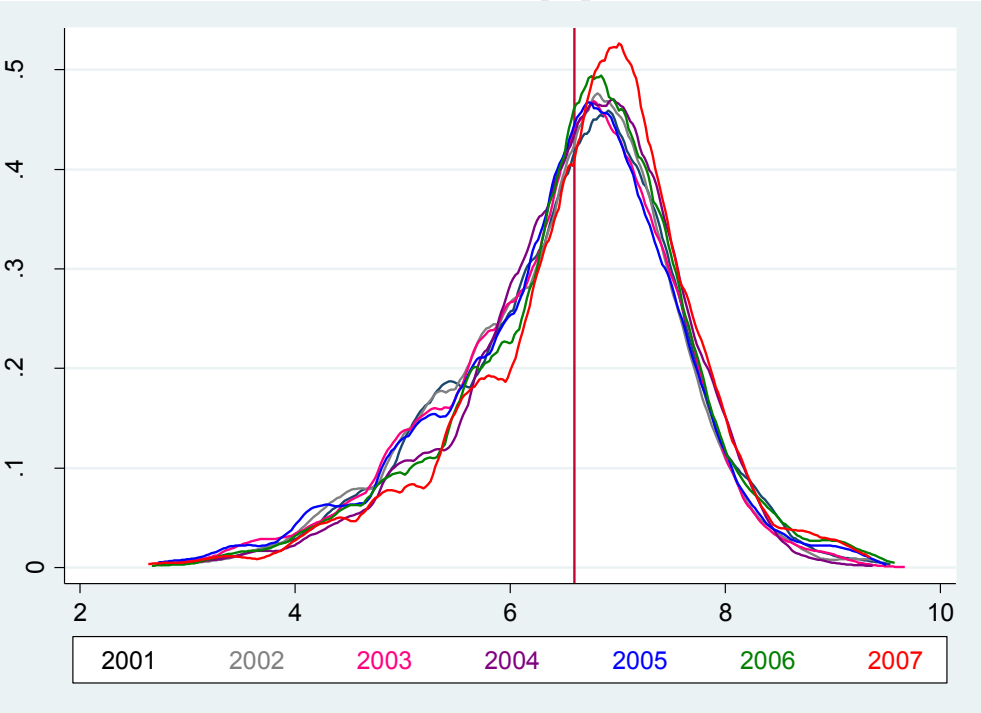
Data are from the September Waves of the LFS 2001-2007. The vertical line is the level of the full-time minimum wage in 2003. Each wave of data contains between 3801 and 4507 observations. Kolmogorov-Smirnov tests for equality of distributions are not rejected at the 5% level for each pairwise comparison of waves in the before and after periods.

Figure 6: Distribution of Farmworker Log Real Monthly Earnings (2001-2007)



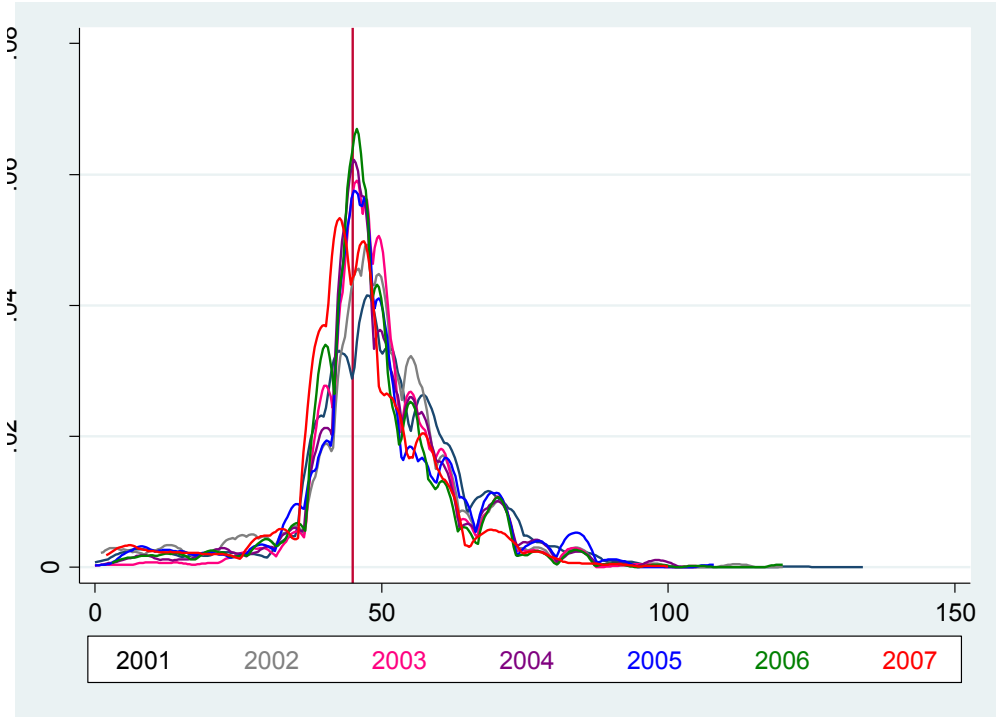
Data are from the September Waves of the LFS 2001-2007. The vertical line is the level of the full-time minimum wage in 2003. Each wave of data contains between 1811 and 2417 observations. Kolmogorov-Smirnov tests for equality of distributions are rejected at the 5% level for each pairwise comparison of waves in the before and after periods.

Figure 7: Distribution of Control Group Log Real Monthly Earnings (2001-2007)



Data are from the LFS 2001-2007. The vertical line is the level of the full-time minimum wage in 2003. Each wave of data contains between 3801 and 4507 observations. Kolmogorov-Smirnov tests for equality of distributions are not rejected at the 5% level for each pairwise comparison of waves in the before and after periods.

Figure 8: Usual number of hours worked per week



Data are from the September Waves of the LFS 2001-2007. The vertical line is set at 45 hours. Each wave of data contains between 1809 and 2381 observations. Kolmogorov-Smirnov tests for equality of distributions are not rejected at the 5% level for each pairwise comparison of waves in the before and after periods.

Table 5: Probability of working as a Farmworker

VARIABLES	(1)	(2)
POST	-0.1528***	-0.13676***
	(0.00161)	(0.00155)
Wage Gap	0.0364***	0.0229***
	(0.00222)	(0.00215)
Wage Gap*POST	-0.0418***	-0.0327***
	(0.00270)	(0.00261)
Controls for Education, Age, African	NO	YES
Constant	0.0580***	0.378***
	(0.00128)	(0.00272)
Observations	320,171	320,171
R-squared	0.002	0.072

Robust standard errors in parentheses. All regressions are weighted. *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is whether the individual is employed as a farmworker (1) or not (0). The sample includes individuals of working age who are unemployed or searching for work who have no more than 12 years of education. POST = 1 after March 2003 and 0 otherwise. The Wage Gap is the district level difference between the log of median farmworker wages and the log of median wages for the control group.

Table 6: Log Hourly Wages, Difference-in-Differences

VARIABLES	(1)	(2)	(3)
POST	0.284***	0.340***	0.388***
	(0.00840)	(0.0624)	(0.0530)
Farmworker	-0.548***		
	(0.0118)		
Farmworker*POST	0.176***		
	(0.0157)		
Wage Gap		-0.154*	-0.1394*
		(0.0811)	(0.0708)
Wage Gap*POST		0.221**	0.1751**
		(0.101)	(0.0907)
Controls for Age, African, Education		NO	YES
Constant	1.338***	0.871***	0.687***
	(0.00666)	(0.0495)	(0.0560)
Observations	90,986	33,892	33,575
R-squared	0.063	0.068	0.228

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions are weighted. Regression 1 is run on the sample of farmworkers and the control group. Regressions 2 and 3 include only farmworkers. Regressions have the 'Log of Hourly Wages' as dependent variables. POST = 1 after March 2003 and 0 otherwise. The Wage Gap is the district level difference between the log of median farmworker wages and the log of median wages for the control group.

Table 7: Contract Coverage, Difference-in-Differences

VARIABLES	(1)	(2)	(3)
POST	0.124***	0.140***	0.169***
	(0.00475)	(0.0145)	(0.0144)
Farmworker	-0.170***		
	(0.00613)		
Farmworker*POST	0.0561***		
	(0.00801)		
Controls for Education, Age, African		NO	YES
Wage Gap		-0.178***	-0.132***
		(0.0189)	(0.0188)
Wage Gap*POST		0.0876***	0.0331
Constant	0.496***	0.421***	0.443***
	(0.00382)	(0.0108)	(0.0128)
Observations	69,743	31,218	31,017
R-squared	0.040	0.038	0.064

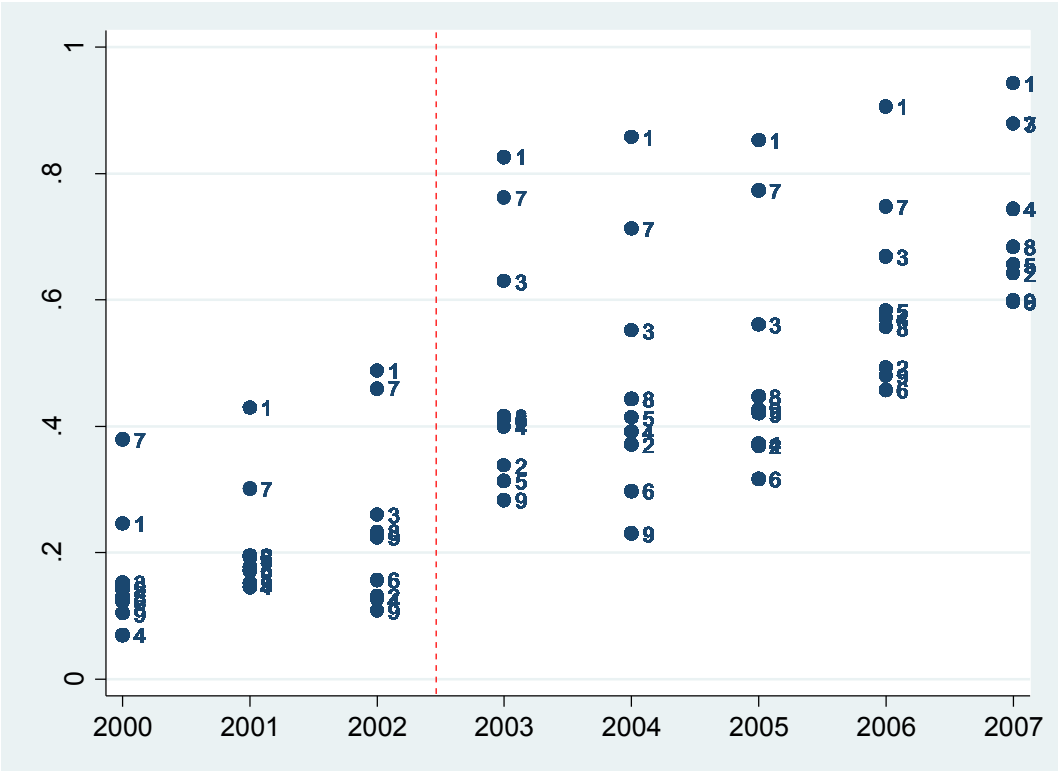
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions are weighted. Regression 1 is run on the sample of farmworkers and the control group. Regressions 2 and 3 include only farmworkers. The dependent variable is whether the individual has a written employment contract (1) or not (0). POST = 1 after March 2003 and 0 otherwise. The Wage Gap is the district level difference between the log of median farmworker wages and the log of median wages for the control group.

Table 8: Usual Hours of Work, Difference-in-Differences

VARIABLES	(1)	(2)	(3)
POST	0.1807	0.0268	0.190
	(0.132)	(1.078)	(1.075)
Farmworker	1.642***		
	(0.189)		
Farmworker*POST	0.106		
	(0.0911)		
Controls for Education, Age, African		NO	YES
Wage Gap		1.085	1.096
		(1.670)	(1.650)
Wage Gap*POST		-0.455	-0.579
		(1.897)	(1.881)
Constant	47.53***	48.60***	50.21***
	(0.105)	(0.892)	(0.939)
Observations	95,399	34,560	34,231
R-squared	0.003	0.000	0.004

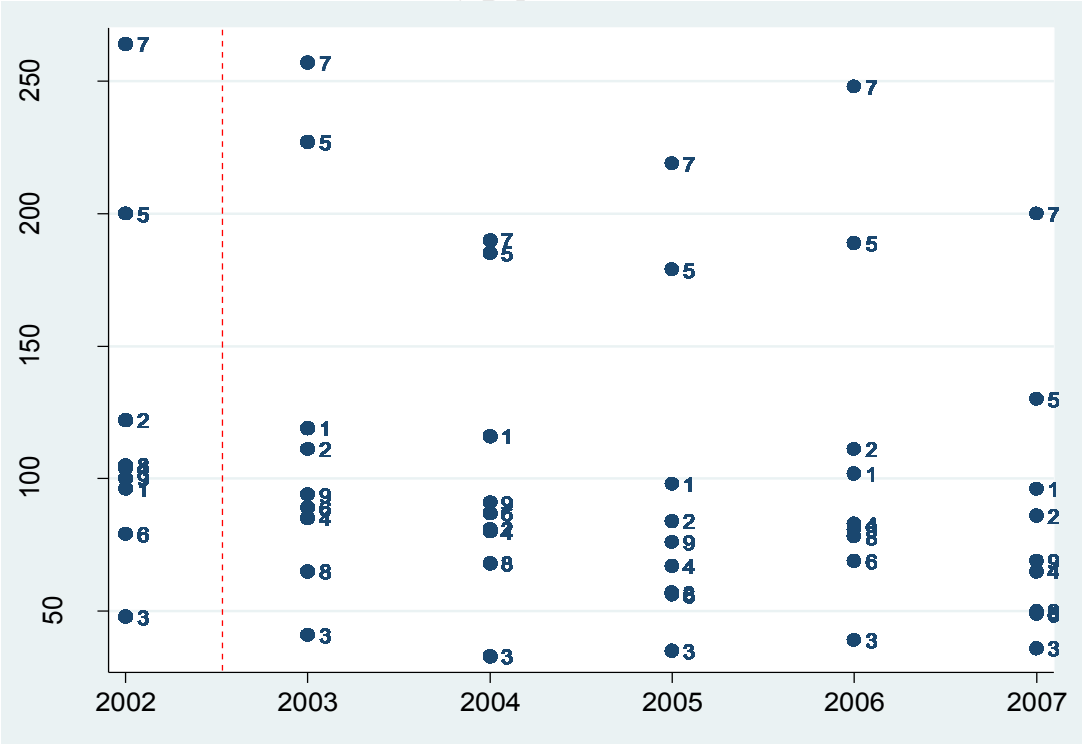
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions are weighted. Regression 1 is run on the sample of farmworkers and the control group. Regressions 2 and 3 include only farmworkers. The dependent variable is whether the individual has a written employment contract (1) or not (0). POST = 1 after March 2003 and 0 otherwise. The Wage Gap is the district level difference between the log of median farmworker wages and the log of median wages for the control group.

Figure 9: Levels of Compliance, per Province (2000-2007)



The dashed red line represents the timing of the law. Provinces are coded as: 1-WC, 2-EC, 3-NC, 4-FS, 5-KZN, 6-NW, 7-GTG, 8-MPM, and 9-LMP.

Figure 10: Number of Inspectors per Province (2002-2007)



The dashed red line represents the timing of the law. Provinces are coded as: 1-WC, 2-EC, 3-NC, 4-FS, 5-KZN, 6-NW, 7-GTG, 8-MPM, and 9-LMP.

Table 9: The effect of Formal Enforcement

	Using Inspector proxy			Using Labour Centre Proxy		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
POST	0.267***	0.338***	0.299***	0.371***	0.398***	0.395***
	(0.0727)	(0.0606)	(0.0700)	(0.0429)	(0.0346)	(0.123)
Inspectors	-0.000561	0.000658	0.00260***			
	(0.000526)	(0.000498)	(0.000735)			
Inspectors*POST	0.00155***	0.00147***	-0.000567			
	(0.000581)	(0.000548)	(0.000761)			
Wage Gap			-0.261***			-0.313*
			(0.0879)			(0.173)
Inspectors*Wage Gap			-0.00543***			
			(0.00111)			
Inspectors*Wage Gap*POST			0.00351***			
			(0.00112)			
Labour Centre				-0.0202**	0.00453	-0.0722**
				(0.00914)	(0.00810)	(0.0330)
Labour Centre*POST				-0.00221	0.0150	-0.0804
				(0.0144)	(0.0120)	(0.0746)
Labour Centre*Wage Gap						0.0894*
						(0.0535)
Labour Centre*Wage Gap*POST						0.00166
						(0.0742)
Controls for Education, Age, African	NO	YES	NO	NO	YES	NO
Constant	0.879***	0.484***	0.704***	0.845***	0.432***	1.023***
	(0.0664)	(0.0682)	(0.0849)	(0.0319)	(0.0412)	(0.104)
Observations	27,423	27,170	26,790	31,667	31,376	31,667
R-squared	0.058	0.218	0.062	0.077	0.257	0.083

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Standard errors for the first three regressions are Eicker-White, clustered at the province level. All regressions are weighted. Regressions have the 'Log of Hourly Wages' as the dependent variable. POST = 1 after March 2003 and 0 otherwise. For the first three regressions the 'Inspectors' variable is used as a proxy for enforcement and identifies the weighted number of Labour Inspectors per province over time. The final three regressions use the presence of a Labour Centre at the district level. Both sets of regressions include a triple interaction term.

Table 10: Compliance Equation, Western Cape (2007), Scenario Analysis

VARIABLES		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Probability of Inspection	λ	0.30	0.25	0.15	0.11	0.05
Annual Minimum Wage (2007)	M	12 492	12 492	12 492	12 492	12 492
Annual Median wage	w	10 764	10 764	10 764	10 764	10 764
No. Violated Workers per farm	L	12.32	12.32	12.32	12.32	12.32
Elasticity of labour demand	n	-0.40	-0.70	-1.00	-1.30	-1.50
% of back wages penalty	k	2	1	0.75	0.50	0.25
Average time to Court	t	0.5	1	1.5	2	3
LHS of Equation (Benefit)		15 381	16 864	19 548	20 924	22 660
RHS of Equation (Cost)		18 781	10 032	5 053	3 005	1 004
Net Benefit from Noncompliance (Rand)		-3 401	6 832	14 495	17 919	21 656

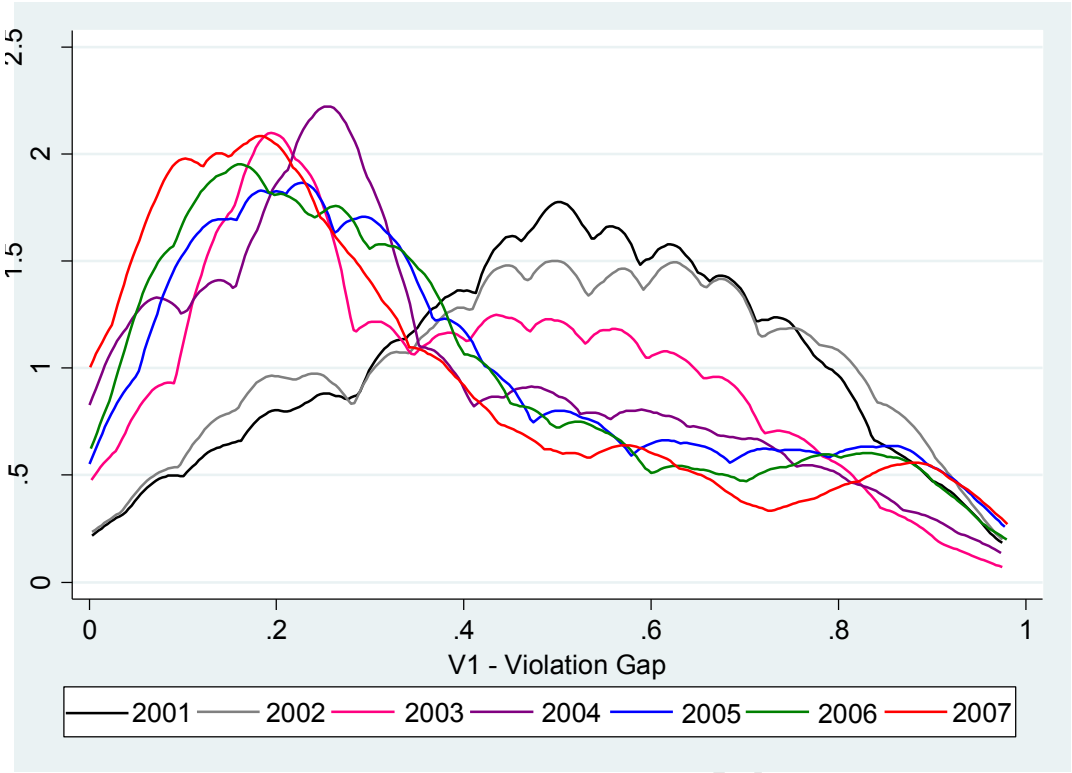
Calculations are based on data from the LFS, IES, and Commercial Agriculture Census. The incentives that face employers in the Western Cape might be somewhat different to those facing employers elsewhere in South Africa. Thus, the scenario analysis provides a picture of how changes in four key variables affect the profit-maximising decision for a typical employer. These variables are: The probability of inspection, the elasticity of labour demand, the % of back wages paid as a penalty (based on the number of previous violations), and the time taken for a violating employer to be convicted. Moving rightwards across the table, these variables are all adjusted gradually to show how changes increase the benefits from noncompliance.

Table 11: Index of Violation (2000-2007)

	Area A		Area B	
	Estimate	Std. Error	Estimate	Std. Error
		V0		
2000	0.82	0.018	0.86	0.013
2001	0.71	0.019	0.79	0.016
2002	0.72	0.020	0.82	0.013
2003	0.62	0.022	0.63	0.019
2004	0.70	0.017	0.71	0.017
2005	0.69	0.026	0.60	0.025
2006	0.60	0.028	0.64	0.021
2007	0.59	0.030	0.66	0.019
		V1		
2000	0.36	0.0156	0.49	0.0150
2001	0.30	0.0143	0.39	0.0111
2002	0.30	0.0167	0.42	0.0138
2003	0.20	0.0149	0.25	0.0117
2004	0.20	0.0095	0.24	0.0110
2005	0.22	0.0151	0.24	0.0145
2006	0.19	0.0202	0.23	0.0132
2007	0.18	0.0216	0.23	0.0123
		V2		
2000	0.21	0.0136	0.33	0.0145
2001	0.16	0.0111	0.23	0.0095
2002	0.16	0.0133	0.25	0.0126
2003	0.10	0.0100	0.13	0.0079
2004	0.09	0.0065	0.13	0.0081
2005	0.11	0.0110	0.14	0.0113
2006	0.10	0.0161	0.13	0.0099
2007	0.09	0.0169	0.13	0.0104
		V1/V0		
2000	0.44		0.56	
2001	0.42		0.49	
2002	0.41		0.51	
2003	0.33		0.40	
2004	0.28		0.34	
2005	0.32		0.40	
2006	0.32		0.36	
2007	0.30		0.36	
N	14612		17316	

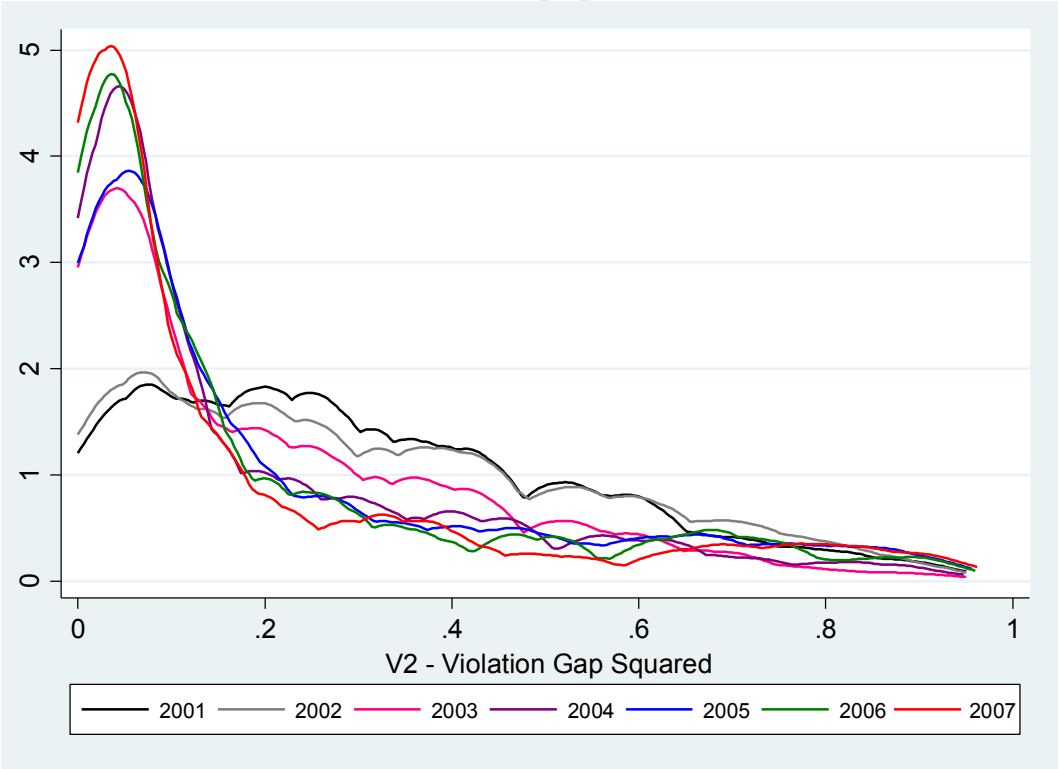
V0 is a simple headcount index which shows the percentage of farmworkers earning below the applicable minimum, V1 is the average distance of wages below the minimum, and V2 is the square of this gap which places more weight on observations furthest below the minimum. V1/V0 allows for the interpretation of V1 and can be read as: workers in year 'x' on average earn V1/V0 below the minimum.

Figure 11: Violation Gap (V_1) density function (2001-2007)



The figure is a kernel density plot of V1 for all farmworkers (Area A and B), calculated using the annual minimum wage.

Figure 12: Violation Gap Squared (V_2) density function (2001-2007)



The figure is a kernel density plot of V2 for all farmworkers (Area A and B), calculated using the annual minimum wage.

Table 12: Partial Compliance, Depth of Violation

	V1		V2	
VARIABLES	(1)	(2)	(3)	(4)
POST	-0.130***	-0.134***	-0.0923***	-0.0963***
	(0.00336)	(0.00324)	(0.00316)	(0.00308)
Controls	NO	YES	NO	YES
Constant	0.465***	0.357***	0.272***	0.177***
	(0.00234)	(0.00761)	(0.00220)	(0.00723)
Observations	21,603	19,486	21,603	19,486
R-squared	0.065	0.145	0.038	0.102

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

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